NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

NASA RELEASE NO. 59-285
DU. 2-6325

For Release AM's of
January 1, 1960

NASA RENAMES HEADQUARTERS UNITS

The National Aeronautics and Space Administration has renamed three of the four major offices in its headquarters organization.

They are:

- Office of Advanced Research Programs (formerly the Office of Aeronautical and Space Research), under direction of Ira H. Abbott, and charged with advanced research in aeronautics and space.

- Office of Space Flight Programs (formerly the Office of Space Flight Development), under direction of Dr. Abe Silverstein, charged with mission planning, payload design and development, and in-flight research and operation.

- Office of Launch Vehicle Programs, a newly-formed headquarters unit (NASA Release 59-270, December 8, 1959), under Maj. Gen. Don R. Ostrander, USAF responsible for development and launch of space vehicles.

The fourth major headquarters unit, the Office of Business Administration, will continue with the same name and functions.

-END-

MR. ROSEN: Good afternoon, ladies and gentlemen. Let me, on behalf of all those present, NASA, wish you all a belated Merry Christmas and a forthcoming happy New Year.

The purpose for bringing you together is to bring you up to date on the results obtained from our Explorer VII scientific satellite.

Now for the ground rules. Each scientist has a short statement to make. The statements are not prepared; they are all on notes, rough notes. You have decided that you will have questions and answers after each one of the statements.

Transcripts of the proceedings will be available some time tomorrow afternoon

There are some statements I have to make for the record as well.

This satellite we are going to talk about, Explorer VII, was designed to gather scientific data as part of the U.S. contribution to the International Geophysical Year. It was the last firing of the IGY planned series of space experiments. Therefore, it was sort of nicknamed as the IGY radiation satellite.

Just to review for you some of the things that have occurred: This is Explorer VII. It was launched by a Juno II booster on October 13, 1959, at 11:31 a.m., Eastern Daylight Time. The scientific payload weighed 92.3 pounds. As of November 28th, the perigee was 346 miles; the apogee, 673 miles; its period is 101.32 minutes; velocity at perigee, 17,274 miles per hour; velocity at apogee, 16,049 miles per hour.

As I said, each of the scientists here will review the experiments that they were responsible for and I would like to list for you the companies and the experiments that were involved. Outside on the table there are copies of this project background and experiments.

ABMA was responsible for the packaging, testing, and temperature measurements. NASA was responsible for the micrometeorite experiment. The State University of Iowa, the radiation experiment. The University of Wisconsin, heat balance experiment. The Naval Research Laboratory, the Lyman-alpha X-ray experiment. Bartol Research Foundation of Franklin Institute, and Research Institute for Advanced

Studies of Martin Company were responsible for the heavy cosmic ray experiment. The Army Signal Corps provided the solar cell and power rings. Bulova Watch Company, the radio transmitter timer. Hoffman Electronics Corporation has manufactured the solar cells.

Here are the participants. Dr. Homer E. Newell, in the center, will be your moderator. He is the assistant director for space sciences of NASA Office of Space Flight Development.

Let's see if I can tie names and faces together. From my right, Harry Carpenter, operations manager of NASA's world'wide tracking network.

Dr. Martin A. Pomerantz, director of the Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania.

I know the next one is Brian O'Brien -- they have left your name off of here, or I can't find it. They have. This is Brian O'Brien of the State University of Iowa. He is a native of Australia. He is one of Dr. van Allen's assistant professors at the University.

Then we have Herman E. LaGow, who heads the Planetary Atmospheres Branch, NASA Goddard Space Flight Center.

Next is Dr. Newell.

Then we have Arthur W. Thompson, Research Projects Laboratory, ABMA, Redstone Arsenal, Alabama.

Mr. Josef Boehn, Guidance and Control Laboratory, Army Ballistic Missile Agency, Huntsville, Alabama.

Mr. Gerhard Heller, Research Projects Laboratory, ABMA, Redstone Arsenal, Alabama.

Then Dr. Verner E. Suomi, Professor of Meteorology and soils, University of Wisconsin.

Now, with respect to the order of presentation, we will first have trapped radiation belts by Mr. O'Brien, meteorological data by Dr. Suomi, temperature control information by Mr. Heller, cosmic ray experiments by Mr. Pomerantz, the solar radiation experiment being read by Mr. LaGow who will also talk on the micrometeorite erosion, Mr. Thompson on the solar cell experiment, and Mr. Boehn on the satellite bearing.

I will turn the proceedings over to Dr. Homer E. Newell.

MR. NEWELL: Thank you, Herb.

On behalf of Space Sciences, let me add my welcome to Herb Rosen's.

The satellite we are talking about is the one that for sometime now has been known as the heavy IGY satellite, or composite radiation satellite. As you undoubtedly are well aware, and as will become more apparent during the discussion this afternoon, this satellite, like all others, is the result of a team effort and such a team needs an able project manager to keep it working, keep things tied together. The project manager in this case is Herman LaGow, and I am going to ask him to pick up the discussion and follow through with it.

Herman LaGow.

MR. LaGOW: Thank you, Dr. Newell.

Explorer VII was planned by the U.S. National Committee for the IGY, the technical panel for the earth satellite program under the chairmanship of Dr. Richard Porter. It was designed, constructed, and launched through the efforts of scientists and engineers from many organizations over the country.

This satellite is in a very stable orbit and is working in a very satisfactory manner. It is a very complex assembly and most significant in having a very long life, with an active satellite transmitting scientific data. Already magnetic tape telemetering records from the 20 megacycle transmitter total over 300 miles in length.

Today you will hear a progress report from the experimenters and engineers responsible for this satellite. First I would like to call on Dr. Brian O'Brien.

MR. O'BRIEN: The physics department of the State University of Iowa has two Geiger counters. Broadly speaking, these are designed to study the radiation, cosmic rays and radiation which doesn't fall easily into either of these categories. I may state that the apparatus is working perfectly as of now.

For the convenience of this, making two will separate the research into studies of two types of phenomena, one of these are called long-term effects and the other short-term effects. By long-term effects I mean variations, for example, in the intensity or the position of the trapped radiation zones over metric months. Since we hope that the apparatus will operate until the transmitter pulse switches off in about a year, the long life of Explorer VII is giving us an excellent opportunity for studying these long-term effects. Equally so, since they are long-term effects, I can't report any of them to you at present.

In the area of short-term effects we included, for example, the effect on the outer radiation zone of the geomagnetic storm. Although each short-term effect can be studied as a single entity, it is, of course, better in general to study several examples of each type. The expected long life of Explorer VII is also an advantage here since we are hopeful of getting several examples of these relatively rare phenomenon.

I will discuss three particular short-term effects that we have observed to date. I do want to emphasize that in two of these cases we have so far only found one example of each. On several occasions the apparatus has detected what appear to be bursts of sporadic radiation near the inner edge of the outer radiation belt. These bursts may be related to the bursts of X-rays which are observed at balloon altitudes, but at present we can only say that the cause is unknown or uncertain.

Another thing we have found from a study of the sequence of passes over North America from the 16th of October through to the 20th was an effect which apparently is related to a geomagnetic storm which began on the 18th of October. On the 18th of October only, the counters measured radiation which appears to have been generated about 20,000 kilometers -- let's call that 13,000 miles -- out from the center of the earth and that is between the two radiation belts. This phenomenon is being compared with results from Explorer IV, in which geomagnetic storms during 1958 were being studied.

The third phenomenon I want to mention is associated with what we call the Forbush phenomena. On occasions over many years people with cosmic ray detectors on the ground have observed a sudden decrease in cosmic ray intensity, generally only of a few percent and then this gradually covers over a period of several days. Quite often this Forbush decrease is associated with the geomagnetic storm.

Now, the sea-level detectors only study very high-energy cosmic rays. Recently Doctors MacDonald and Weber, from outside Iowa, have flown balloons to study the effect of the Forbush decrease on somewhat lower energy cosmic radiation and they have found that the effect is much stronger for these lower energy particles than it is for the high energy ones they have observed at sea level.

Now, with Explorer VII we can study even lower energy particles. We studied one sequence using data provided by Dr. Hugh Carmichael in Canada. He has sea level measurements and he has found for one particular Forbush decrease a nine percent change in his counting rate over a period of many days, whereas Explorer VII has found something like two to three hundred percent change. If I might round that off, the Explorer VII insofar as we can measure lower energies still than the balloon observations, we are pushing this study to even more interesting ranges.

I want to conclude with a summary which will indicate that the State University of Iowa apparatus was designed using results obtained with our apparatus on previous Explorers, three previous satellites, and also using results of other people and the results from this present satellite will be used in conjunction with previous results as a further step towards the final understanding or near final understanding of these phenomena. Explorer VII is just fitting a few more parts into the jigsaw puzzle.

Thank you.

MR. ROSEN: Are there any questions?

QUESTION: You say this is a 200 to 300 decrease, sir?

MR. O'BRIEN: The Forebusch decrease; we have the steady cosmic rays and then there is a decrease in intensity and then it gradually recovers over a period of many days, while the magnitude of that recovery is 200 or 300 percent on the intensity at the bottom of the decrease.

QUESTION: Would you draw us a curve of what you are talking about?

MR. O'BRIEN: Yes.

I am just going to draw counting rates up there, and I am going to draw time across here; then the normal cosmic ray intensity would come along here somewhere, then there is a Forbusch decrease which in the sealevel measurements is only a few percent and then this gradually recovers over a period of many days until it comes up about to that level again.

Now, in the satellite, this is all purely results which were discovered about half a day before I left Iowa, so they are rather preliminary. The decrease is more pronounced and the recovery is also more pronounced. You have probably got some effect like this in which if that is 1, this is 2 to 3.

QUESTION: So, you are getting a 200 to 300 percent decrease in intensity at that period?

MR. O'BRIEN: Yes.

QUESTION: Why? Do you have any theories?

MR. O'BRIEN: I told you, I mentioned that it only came out half a day before I left Iowa, which is not very long.

QUESTION: Any ideas at all as to when?

MR. O'BRIEN: Well, it gives us a hint since we are studying the lower energy particals here, this does give us some hints as to the mechanism, but, I prefer not to go into those here. They are a little bit complex.

QUESTION: As to the mechanism of what?

MR. O'BRIEN: The mechanism which causes this Forbusch decrease which is associated with geomagnetic storms.

QUESTION: What energy cosmic rays are you talking about here?

MR. O'BRIEN: These ones involved here in the satellite are approximately a third of a billion electron volts, one-third of a billion. This is the American billion; 10^9 electron volts.

QUESTION: In other words, about 130 Mev?

MR. O'BRIEN: Yes.

Now, these ones here are of the order of several thousand Mev, the sealevel ones. The balloon observations are somewhere in between the two.

QUESTION: What are the earth-based ones again?

MR. O'BRIEN: We can call it -- do you want it in absolute measurements or relative?

QUESTION: Roundhouse.

MR. O'BRIEN: Ten thousand million electron volts. And the balloon observations are approximately a thousand million electron volts.

QUESTION: Pardon me, you just said the earth ones were ten thousand million - you mean ten thousand electron volts?

MR. O'BRIEN: No.

MR. POMERANTZ: Your earth ones are one to ten billion volts Mev.

MR. O'BRIEN: Explorer VII; on point 3.

QUESTION: Since these decreases are associated with geomagnetic storms, is it possible that these new findings might throw further light on the nature and mechanism of geomagnetic storms and their effects on radio communications, blackouts and things like that?

MR. O'BRIEN: We are sincerely hopeful of this, yes.

QUESTION: Is this an indication that the source of these low energy cosmic rays is the sun?

MR. O'BRIEN: I hesitate to make anything as definite as that. It depdnds on how we define a source, it is not necessary that the sun actually spits these out and that they travel as particles all the way. They might be just sitting out there in the upper atmosphere waiting for some effect which is caused by something from the sun.

Now, I would like to point out to you that here we are indebted to the courtesy of Drs. MacDonald and Weber and this is a pre-publication result.

QUESTION: Presumably these low energy ones never reach the earth, is that right?

MR. O'BRIEN: That is right, yes. The atmosphere acts as a sort of shield here and this is why the people at ground stations have been limited for so long because you have got an effective blanket of the atmosphere over the earth and only these ones, these very high energy ones, can get through to the ground level detectors. You go up in a balloon to a hundred thousand feet, you can see a little bit better; you go up in a satellite to several hundred miles and you can get down to this rating.

QUESTION: All of these measurements made with the VII were made below the innermost Van Allen radiation belt?

MR. O'BRIEN: Yes, these are -- I prefer not to say so much below as away from the radiation belts.

QUESTION: What was the latitude or the inclination of this orbit?

MR. O'BRIEN: These are all over North America. We have compared -- we knew that a Forbush decrease was going on by using Canadian ground level measurements and we studied Explorer VII measurements over roughly the same region in space where the trapped radiation was not very large.

QUESTION: And did you find that happening just once to date since the satellite was launched?

MR. O'BRIEN: Yes.

QUESTION: In other words, you just had one geomagnetic storm in the interval.

MR. O'BRIEN: We have only got one that we have found to date. There are several geomagnetic storms which have occurred since the satellite went up.

QUESTION: Then do you mean you haven't gotten around to examining the records yet?

MR. O'BRIEN: Yes.

QUESTION: I see.

MR. O'BRIEN: This is not an immediately obvious method of attack.

MR. ROSEN: Are there any more questions on the radiation experiment?

QUESTION: Have you ascertained any more about the composition of the inner and outer belts and particularly this suspected third lower belt, the proton belt?

MR. O'BRIEN: Well, this is still a matter of considerable discussion among us. One of the phenomona I reported was an enhancement of the radiation in between the two radiation belts. Now, this only lasted one day in our particular sequence of observations. If I might draw that.

We have got inner zone here, measuring intensity as we move out from the earth. We have got the inner zone relatively shallow intensities coming up to the Alpha zone.

Now, in this particular sequence I mentioned we have found a double hump type of thing there which only lasted one day while a geomagnetic storm was on.

Now, this sort of thing has been found in several of the Explorer IV studies we have been making so this is not a -- you can't call this a revolutionary new discovery. This whole problem is still being discussed as to how far down you have got to track here, because you see, all these observations are made with detectors which respond just a little bit differently to the radiation and it is quite conceivable that with some detectors you will get this sort of thing.

QUESTION: What you are discussing now, the point that you first made, the sporadic radiation near the inner edge of the outer belt, is that what you are now referring to?

MR. O'BRIEN: No, this is the second point I discussed.

QUESTION: Could you go to the first point, could you go into that a little bit more? What are the relative sizes of these sporadic bursts and so forth?

MR. O'BRIEN: I have a graph here, I don't think-- you probably won't be able to pick it up. These occurred over North America again, the ones we found. We thought the gain intensity versus time. This is now on a very short scale, with that being one minute, that being two minutes. This type of scale now, not a matter of many minutes as here. We have got the outer zone comes up like this. This is as the satellite moves south so that we have got a plot here in time, we have also got a plot moving towards the equator. The outer zone is at high latitudes and as we come down from it we find peaks of this form; this is only a very rough sketch, but these may be almost twice as large. The size of peak may be as large as the size of the more or less background radiation and the actual widths of these peaks are only of the order of seconds, perhaps ten seconds you could take as a working average, and they are separated by approximately thirty seconds, or something like this.

Now, it could be since this is also a distribution in space as we are moving south, you might interpret this as passing through a sequence of zones. We are inclined to think at this stage -- but this is purely personal interpretation and as yet we have got no convincing evidence of this -- we are inclined to think that these are bursts in time rather than bursts in space, simply because this was a certain Greenwich Mean Time that we happened to count that radiation there

QUESTION: Could these be bursts of protons from the sun?

MR. O'BRIEN: They are unlikely to be protons, but even there I would be -- at this stage we cannot answer that definitely.

QUESTION: These were observed at times of solar disturbance?

MR. O'BRIEN: Yes, this may or may not be fortuitous, we just can't tell. Actually, if you are interested, one of these occurred a few hours before we saw this, this latitude enhancement. In the other case, this one occurred when we saw no low latitude enhancement.

QUESTION: I would like to transfer this over to Dr. Newell, whether this doesn't tend to confirm Malcolm Ross; that these outbursts of protons from the sun might produce hazards to any outer space travel for man?

MR. NEWELL: If I could answer that question on a broader basis than which you put it. All of these things that we are looking into are leading to a broad picture of what's going on out in the region around the earth, and although when the radiation belt was first discovered by Van Allen one more or less felt here was a single radiation zone; then later he determined two zones, and now we find that even that has structure, that if you look at this in different energy regions you find zones of particles of those different energies. We are now getting a very complicated picture of which this is a piece, and the next measurement will be another piece, and so on and so forth. So, when you ask Dr. O'Brien here whether these are protons from the sun you ask him to try to fit this observation into a big picture that he as yet doesn't have. This is why he says that you can't be sure. This has to meet a lot of tests.

Now, if I may come back to your specific question, the more of the energetic particles we find, the more protons, particularly energetic particles we find the more of a hazard we find for explorers who are going out into space, so that if this does tie in with Mal Ross' observations and Winkler's observations, my answer is, Yes. My view, if this does tie in. We have got to tie it in.

MR. ROSEN: May we cut this off and go to the next speaker?

MR. LAGOW: Next I would like to hear from Dr. Vernon Suomi from the University of Wisconsin on the radiation balance experiments.

DR. SUOMI: Meteorological experiments on board the Explorer VII measures the thermal radiation budgets of the earth below. Radiation in this case is merely the light and heat most of us are familiar with. The budget is determined by the amount of sub-light which strikes the top of the atmosphere, the fraction that is reflected by the earth's surface clouds and atmosphere and never enters the thermodynamic system and the radiation lost by the atmosphere by virtue of the absolute temperature.

Bodies above absolute zero radiate heat. The net radiation received by the earth's surface depends on the latitude, time of the year, time of the day. These are more or less fixed. The net radiation also depends on the structure of the atmosphere below, particularly cloudiness. The weather affects radiation and at the same time the unequalled distributionof this radiation is basically the source of the world's weather. It is possible to measure or estimate the net radiation which exists on the average and radiologists have done this some years ago.

It is more difficult to do this for a short period of time such as a week or month. Here is where the satellite is of questionable help. Actually the detectors on board Explorer VII are simple, indeed. The hardware necessary to get the information back to the earth is the part that is complicated. It is not so much what they are as where they are that is important.

Explorer VII is making about 4,000 radiation observations here today. Of these about a tenth to a quarter are actually received by the telemetering stations. We must analyze much more data before any statement can be made about the heat budgets of the earth obtained from the Explorer VII measurements and any effect it might have on the weather.

However, the measurements already show details of interest to the meteorologists and perhaps also to the average citizen who is paying for this experiment.

While the satellite was not designed to look at details in the weather below it does indicate clouds or storm areas about a thousand miles across. This shows up readily on the sunlight portion of the earth because of the large amount of reflected sunlight.

However, it is also possible to relate the changes in long-wave heat radiation on the dark side of the earth to positions where cold or warm air exists.

If this comparatively crude experiment can do this, more sophisticated satellites now being planned and under construction can recognize storm systems even on the dark side of the earth.

We have also noted that the variation in radiated heat loss over an area about the size of the United States is about as large as the average variation from pole to pole. What I am trying to say is that just over small areas one gets large changes in the heat loss from the earth.

In addition, mass balloon ascents sponsored by the U. S. Weather Bureau carrying radiation measuring instruments have allowed us to make comparison with the satellite mission.

The engineering portion of the experiment is over and many individuals who contributed to the over-all experiment deserve our heartfelt thanks. Now we are getting a chance to look at the forest as well as the trees as far as the radiation budget is concerned and we are looking forward to this interesting phase of the experiments.

MR. ROSEN: Are there any questions?

QUESTION: Could you repeat the statement which I did not quite follow about over the United States, areas of the United States you were getting heat loss equal from the poles?

DR. SUOMI: What I am trying to say is that if one were to make a plot of the change in heat loss from the earth from pole to equator we lose more heat over the equator than the poles. The difference is about 25 per cent.

But even over a small area of the United States the heat loss from the earth goes through an undulation about the same size as the average change from pole to equator not as large as the whole change but a large fraction of it.

QUESTION: You say we lose more heat from the equator?

DR. SUOMI: Yes.

QUESTION: This is not very astounding, is it?

Would you expect this?

DR. SUOMI: Yes, we would expect this, but what we are after in this experiment is to see if we can relate this to weather effects which might occur.

For example, last November up in the Mid-West was very cold; however, December was rather mild. Now, this weather difference must ultimately be related to the distribution of the temperature, this in turn must be related to a heat as distributed around the earth.

Some of this is caused by the input to the earth from the sun, to be sure; the other is by its loss and this is also redistributed by the weather systems themselves.

So one can make an average picture for a long time; they have to balance out, but if things do not balance out on a short time basis this will give us a key, I think, to the processes.

QUESTION: You have a number of these readings apparently and you also have weather bureau records for this period of time.

Is there any preliminary tie-in between the two?

DR. SUOMI: Oh, yes. If I look at a weather map and look at the satellite record it is possible to relate the variations in the satellite record to the weather map; but you can see that at this stage I am not very confident because the key to it is to go in the reverse direction; to take the variations measured by the satellite and say there are things below.

At the present time we just are finding these relationships, we really need to have much more data and increase the confidence in them.

QUESTION: Going back to this, In November, did you record a high loss of radiation of heat in the earth's surface in the Midwest area?

DR. SUOMI: We had a situation where cold air was

In the Northeast, with a low in the vicinity of Wisconsin, and warmer air to the southwest. As the satellite passed in the northeast, passed from southwest to northeast, the change in radiation, this was all at night, the change in heat loss from the earth went through a violent change as it passed over this boundary.

This was also in agreement with the radiometer sounds released by the weather bureau. So, there is this relationship between air temperatures and types of air and the records received by the satellite.

MR. ROSEN: Does that about do it?

QUESTION: I think you indicated that even as regards the non-sunlight side of the earth, the satellite has made some findings with regards to the heat budgets.

DR. SUOMI: What I am trying to say is that this experiment really was designed to look at the earth in large area. Actually upstairs we do not have a camera, so to speak, we just barely have film, but even this crude device is able to detect variations in the radiation pattern from the earth associated with weather.

This means, then, that as our more sophisticated satellites are placed in orbit it will be possible to obtain cloud patterns and so on on the dark side of the earth as well as on the sunlight side.

QUESTION: Could you establish anything further from that picture that we were exposed to at one time from Explorer VII? Did that show up to be rather significant or was it a --

MR. ROSEN: I am sorry; did it tie in at all with --

DR. SUOMI: I have not attempted to tie this in at all with any of our measurements, Idon't even know if it occurred at the same time.

MR. ROSEN: They certainly over a different area, too, Peter.

QUESTION: That was over the Pacific, yes.

MR ROSEN: Are there any more questions?

MR. LAGOW: Next we will have Mr. Gerhard Heller, from the Army Ballistic Missile Agency, tell us about the temperature measurements and the heat balance on the Explorer VII.

MR. HELLER: The temperature problems of Explorer VII are two-fold, firstly, the design of the satellite has to assure proper functioning of all instrumentation within a specified temperature range of zero to sixty degrees centigrade and secondly, the second aspect of the termal problems is that six temperature measurements were placed as part of the scientific experiments. I am going to talk first about the thermal design problems.

A new concept has been used in the thermal design of Explorer VII. The instrument package is insulated from the rest of the satellite, however; the two conical halves of the satellite shell are allowed to exchange heat by radiation on the inside.

The basic principle of thermal control used is a passive system. That means that it operates without any moving parts. The central instrument column is covered with gold foil and the internal middle parts are highly polished and minimized with heat radiation transfer.

On the other hand, the fiber glass shells are painted on the inside with a titanium paint with a high infrared passivity.

This concept has allowed to minimize temperature extremes of senders located in the skin of the solar cell packages and of the transmitter inside the instrument column.

Temperature measurements evaluated from the records of the ABMA tracking station have shown during the 78 days of operation a minimum of the transmitter temperature of 16 degrees centigrade and a maximum of 41 degrees centigrade.

The maximum occurred during the period of 100 per cent sunlight from the fifth to the tenth day after launching.

It is reasonable to expect that the temperature will stay within the design limits throughout the active life time of the satellite that is hopefully one year.

Variations are mainly due to the time of sunlight during each revolution and due to the changes of the position of the sun with respect to the attitude of the satellite axis in space. The firing time of Explorer VII has been selected such as to minimize the angular deviations of the sun from the satellite equator.

I might add it actually will not stay constant but will, the position of the sun will oscillate in sinussoidal fashion around the mean position at the equator of the satellite.

In the time span from first of November to 15th of December the temperatures of the transmitter stayed almost constant at 18 degrees centigrade with variations of not more than plus or minus two degrees.

Presently Explorer VII goes through another period of 100 per cent sunlight from the 25th of December to the first of January.

The temperature requirements for the instrument package are determined for the upper limit by the transmitter and the batteries and for the lower limit by the batteries that would freeze out if the temperature drops below zero degrees centigrade.

The solar cells would allow higher temperatures than 60 degrees, if not, their power output will decrease with increasing temperatures.

In addition to the effects of the sunlight-shadow periods and the attitude of the axis to the sun, other important factors on the thermal problems of satellites are the variations of the radiation environment from sun, albino and earth radiation and the change of surface characteristics to the exposure through the environment of space.

Now, to the second part: The experiments of Explorer VII include the measurement of fixed temperatures by senders whose output is transmitted through the telemeter on 20 megacycles. Besides the transmitter temperature or diminution the following temperatures are monitored in a continuous sequence, skin, solar cells, batteries, Geiger Mueller tube and a hemispherical sender of polished gold on the satellite equator.

All experiments are working well and a tremendous amount of valuable information is obtained from the telemetered records of the tracking stations.

Evaluation has been started on the temperature data of the ABMA tracking stations. Correlation with data from other stations and with results of the University of Wisconsin radiation experiment is in progress.

Results from the analysis of the thermal experiment will increase our knowledge of the environment in space and its effect on satellites and will in turn allow us to improve the thermal design of future satellites.

Up to now Explorer VII has given the most complete data coverage of temperature measurements, the experiment is considered very successful.

MR. ROSEN: Peter?

QUESTION: Based on what we have received so far, in the temperature measurements, what improvements would you possible suggest for a future satellite such as this? I say it may lead to improvement, obviously it will. I am wondering if you found any failures or anything that could be improved so far?

MR. HELLER: Well, actually this thermal control worked quite satisfactorily, but requirements for a future satellite as such will increase. We will very likely have to now design down the temperature limits and have more difficult requirements fulfilled. So this information will help us do that.

QUESTION: You said something about you hoped that the active life of the satellite would be one year. You meant one year for giving out information? As I understand it, the lifetime of this aloft is about twenty years, isn't it?

MR. HELLER: The lifetime is much longer.

MR. ROSEN: There is a timer in it to make it stop transmitting in about a year.

QUESTION: Could you draw up a little sketch of this inner and outer shell?

MR. HELLER: I don't know whether everyone can see it. The satellite, what I call equator is this short cylindrical part in the middle; well, it is rotating around this axis, so this corresponds to the equator; this is the upper shell and this is the lower shell; and the main purpose of assuring this radioactive transfer from one side to the other is to minimize temperature extremes. The sun during the oscillation it makes around this equatorial mean position is at the position now, right now it's somewhere here and almost no light would fall on this, and this shell would run considerably hotter then the lower shell, and again this would affect all temperature extremes in the satellite.

This rate of transfer is considerable. Actually, it's quite interesting to learn during the process of this design that it could not be conducted from one side to the other even with very heavy copper bars. The radiation transfer is quite effective.

MR. ROSEN: Yes, Al.

QUESTION: You mentioned a little closer control might be necessary to future satellites. This appears to me, a 25-degree variation to be very small, even much smaller than you will find in a few thousand feet on earth.

MR. ROSEN: Did you mention that?

MR. HELLER: That is right, at present this is the transmitter temperature, the inside, which is now in a favorable position. Now, other temperatures definitely are higher and also lower at different parts of the satellite.

QUESTION: Do you have figures for the high and low skin temperatures?

MR. HELLER: Yes, we have some figures. I hesitate to quote these for this reason, so far we have not a complete cycle which we try to get from all stations so we just -- the temperatures of the skin go to quite some extremes, go up and low, to even temperatures below freezing, so any point we have measured does not give a complete picture because it's just an arbitrary point of such a curve. What we try to do is to run a computing program where we fed in information, correlated this, and then we acquired certain confidence that a specific measurement makes sense.

QUESTION: Could we have those even if they are not complete?

MR. HELLER: Well, they are presently not available in a form. You certainly could have them.

MR. LA GOW: They could be made available?

MR. HELLER: They could be made available.

QUESTION: Could you give us a rough estimate, your memory of it?

MR. HELLER: We have temperature measurements on the skin -- maybe I can sketch it somewhat.

A typical cycle of a skin temperature during one revolution would look somewhat like this, this being the shadow area and we enter sunlight, we have a steep rise and the maximum is not at the end point, at the end of the shadow again because the maximum is where all radiation total is at a peak including the albedo and we have a drop of the albedo in this region. And then, of course, a steeper drop up in the shadow.

Now, this picture is again dependent on the attitude of the satellite with respect to the sun; so, actually if we would plot the curve for the next day, it might be somewhat different. Also, we have additional changes that this shadow period changes, so in 100 percent sunlight all temperatures are higher and it almost goes through a cycle like this. What we have obtained are, of course, points here, here, here, and so on.

Now, I'll quote a figure which I said cannot give any detailed figure, cannot get a complete picture. We have a value like this and we have values as low as 5 degrees centigrade, this 53. But again we do not know exactly. I put these arbitrarily on the curve here. We do not know exactly where they are and how they correlate, and so if you obtain information it will be very sketchy and will be hard to get together what it actually means. What we are trying to do is to establish such theoretical curves and get, then, measurements that would follow this specific computed curve. We expect some deviations from these to the weather variations and others, and hopefully we can also explain these by correlation with the radiation equilibrium. But unless we have done this, it is a very sketchy picture.

MR. NEWELL: I might make a general comment in here that when the satellite business began, one of the main problems was the question of whether one would be able to control temperatures, and the serious question was whether one would be able to control temperatures in the interior of the satellite in which batteries, transistors and other equipment would operate properly. The results, success of this satellite, and on others, indicate two things: one, that we have been able to handle the problems that we faced so far; and two, looking forward to the future one may expect to be able to produce temperatures in limited regions, in cavities, for example, in Deer Flasks that stay constant for a fraction of a degree for such things as velocities and so on.

MR. ROSEN: All right.

MR. LA GOW: Next we will have Dr. Martin Pomerantz describe the heavy cosmic ray experiment that he and Dr. Philip Schwed have done.

MR. POMERANTZ: I am simply acting as spokesman today for a group consisting of the group of Philip Schwed, who is in the audience and the late Dr. Gerhart Groetzinger, who passed away before this satellite was launched.

This experiment was designed to investigate the heavy primary cosmic rays. These consist of heavy atoms stripped ofexternal electrons and endowed with very high energies.

They come from the far reaches of our galaxy and have traveled vast distances through interstellar space before reaching us.

We can learn much of fundamental interest by studying their characteristics. For example, the chemical composition of the sources of cosmic radiations reflected in their abundances.

It is remarkable that heavy primary cosmic rays can withstand the process whereby they acquire their energies without splitting up any theory of the acceleration mechanism must account for the characteristics of this component.

Furthermore, the fact that they have survived their long journey yields information about conditions in cosmic space. The particular fraction which we have set out to study comprises those elements heavier than boron on the periodic table.

We wished to determine the energy distribution of these particles, that is the population in terms of the energy, and the possible changes with time.

For the former purpose it is necessary to know with considerable accuracy the variation of their rate of arrival with geographic location.

record
The data/ is accomplished obviously by monitoring the rate of arrival at fixed locations over extended periods of time such as is feasible with this particular satellite.

The detector employed is a so-called pulsed ionization chamber, and its use enables us to select by means of appropriate electronic cervix cosmic rays, the heavy primary cosmic rays, even in the presenceof a much larger background of radiation of other types. This is the first occasion on which this sort of detector has been used in a satellite experiment. It has proved especially well adapted to this application because it combines a high sensitivity and a great capability for discriminating against interfering effects with an extremely low weight.

The associated electronics, which is less than a pound in weight and is actually a fraction of the size of the detector itself, performs the function of laboratory equipment fifty to 100 times as heavy. The results to date have shown that the desired performance was indeed attained.

Specifically we have been able to obtain a preliminary representation of the energy dependence. As mentioned before, this has been accomplished by determining how the rate of arrival depends upon geographic location of the satellite and, for example, at high latitudes the counting rate is approximately ten times as large as it is at the equator.

It may be remarked that the capability of making such a large scale survey at a rapid rate is one of the great advantages of a satellite vehicle for investigationsof this type.

This device permits a very critical examination of the effects of the earth's magnetic field one charged particles approaching the area and this is very important for a number of very practical reasons, especially in the communications field.

Fluctuations in intensity probably associated with stormsin the sun have been observed but have not yet been studied in any detail.

We expect that the final analysis of these fluctuations will exist in our understanding of the effects of solar influences on cosmic radiation.

In particular, we shall be especially interested in seeking to detect any heavy nuclei emitted directly by the sun -- an occurrence known to transpire in the case of hydrogen, the most abundant component of cosmic radiation obtained when a very intense part of the trapped radiation belts are considerably higher than normal.

The increase is much smaller than that registered by other types of detectors used in the studies of the belts. The existence of this residual counting rate appears to be of considerable significance for understanding the nature of the particle in the belt; and we have initiated further investigations to explore the possibility.

As of the present moment we have not had enough data and the calibrations have not been performed which are required to study the subsidiary question.

MR. ROSEN: Is your instrument calibrated to give energies?

MR. POMERANTZ: It is calibrated to detect particles which have an atomic number larger than a certain minimum value. Carbon is the lightest z equals 6. atomic No.6, and the particles which it detects are relativistic particles, that is the particles moving with the velocity of light.

It would reject the lower energy particles.

QUESTION: Aren't your most powerful cosmic rays the heavy nuclei?

MR. POMERANTZ: Well, if we talk about the usual procedure to cause the energy per nuclei, per particle in the nucleus, these heavy nuclei have energies per nucleus comparable with the nucleus.

This mean. for example, for an atom like iron, that the highest energy one would be able to carry, what is it. 56 times the energy -- whatever the atomic weight is. as compared with the proton.

QUESTION: Howmany elements haveyou detected and what are they?

MR. POMERANTZ: Well. there are groups of carbon, nitrogen and oxygen, and heavier. In other words, there are three regions. minimum atomic numbers. so that one can then determine the whole spectrum within that limitation. The lowest one is 6, 9. and 16. roughly.

One cannot get a very sharp cut off in this calibration because of variation in path length through the chain and things of that sort. but these are the ranges.

QUESTION: Have you detected iron?

MR. POMERANTZ: One cannot specifically say whether there is a nucleus of iron, but there have been particles with atomic numbers larger than 16, some of which certainly could have been iron.

There is no way to identify them.

QUESTION: Well, carbon, nitrogen and oxygen are the only ones you can definitely say you have detected, is that right?

MR. POMERANTZ. That is the lower limit, carbon is the lower limit. In other words, the lowest channel would detect everything heavier than carbon, the next lowest channel would start at a higher place, so they are not mutually inconsistent.

In other words, if a particle is iron, it would send off all three channels.

QUESTION: How would you relate the study in which you were involved, the experiment in which you were involved as it relates to communications with that of Mr. O'Brien?

MR. POMERANTZ: Well, one of the uses, if I may use that term, of cosmic rays is that they serve as a probe having passed through the regions surrounding the earth, so they go through all sorts of magnetic clouds, magnetized clouds, things of that sort, which on occasions can inhibit cosmic rays, prevent them from reaching the earth.

In this sense it is of great interest to compare the changes of the type that Mr. O'Brien has discussed with those on the heavy nuclei which represent the much different energy range of particles.

So, in this sense the investigations are quite related. One point which I should emphasize is that we know that the earth's magnetic field, we understand how the earth's magnetic field affects the orbits of incoming particles and recently we have begun to understand that the ideal conditions that would apply at the earth's field could be represented by a bar magnet, by a dipole breakdown, and it is of great interest to investigate this in detail, the departures from this ideal condition.

Now, these particular heavy nuclei, since the detector is not so susceptible to the variations of altitudes thatother detectors are, afford one an excellent method of studying, of plotting essentially the places where a given magnetic field exists.

In other words, isomagnetic lines, essentially.

QUESTION: There has been some question about the possibility of primary cosmic radiation being detrimental to life on the moon.

Is your experiment likely to shed any light on this?

MR. POMERANTZ: Well, I am afraid this is an area beyond our competence, all our experiment can do is to indicate how many of these particles there are and what their energies are, and then it becomes a biological question to decide whether there are such effects.

I will say this, that the characteristic of heavy nuclei as compared with the protons is that they would ionize very much more densely in a limited region than a proton would since the ionization goes as the atomic number to the second square, z^2, so in terms of ionization they are very intensely ionizing.

What the effect of this is I would hate to guess.

QUESTION: Have you any estimates on how many and what energies they are?

MR. POMERANTZ: The heavy nuclei comprise something like the one per cent of the total cosmic ray intensity that is the galactic intensity, what you would find outside of the radiation belts.

That number is roughly one per square centimeter per second, so this would be one per cent of that, this is a ball park figure, it depends on where you are with respect to the earth's magnetic field, so they are not very plentiful in terms of the intensities that you would find, say, in the radiation belts, for this reason one is hopeful that they may not do very much.

QUESTION: This estimate of one per cent I think is one that was made before this was sent up.

MR. POMERANTZ: Yes, this one per cent is -- this order of magnitude is certainly well-established and this is certainly not a new result.

QUESTION: You have not found anything to disturb that estimate?

MR. POMERANTZ: No; I would say that the kind of counting rate is consistent with the expectation on that ground.

QUESTION: Does that hold true for energies also?

MR. POMERANTZ: In terms of energy, we find that what we measure is essentially the population density in terms of energy and we find that the energy spectrum goes roughly something like one over the energy; this is very crude.

Inother words, there would be ten times as many particles above a billion volts, if you take all of the particles, as above ten billion volts, that kind of order of magnitude. That is very crude.

MR. O BRIEN: Might I add something here which may or may not clarify things?

One of the particular advantages of Dr. Schwed's experiment as I see it is that previous observations of these heavy primaries have been made with balloons.

You do not get heavy primaries at sea level; they fade out so you have to go up in balloons or rockets. Balloons will only stay up there, they are being very favorable to you for 24hours or so. Whereas this present experiment is just going to go whirling around collecting these heavy primaries for about a year and this is quite a fundamentalimprovement.

MR. POMERANTZ: Thank you.

MR. LA GOW: If there are no more questions on that, we will go to the solar radiation experiment. Unfortunately, Dr. Friedman and Dr. Chubb could not be here today, from the Naval Research Laboratory, that sponsored this experiment, so Dr. Chubb prepared a statement which I will read to you.

The solar radiation experiment in Explorer VII has been responding almost exclusively to trapped particle radiation rather than to X-ray and Lyman-alpha radiation from the sun. One can conclude from the experimental data that an experiment to monitor solar X-ray radiation must either be carried out below an altitude of 300 miles. or that means must be provided to protect the thin window radiation detectors from incident electrons. Despite the problems associated with trapped electrons it is felt that valid solar data may yet be obtained when records from the Pacific are studied.

QUESTION: In other words. After all of our futile attempt to put up that experiment. it didn't work?

MR. LA GOW: Well, this is not completely true yet because only a portion of the records, a fairly small portion of the records have been examined and I would like to ask Brian O'Brien to comment on this point.

MR. O'BRIEN: As you may have gathered, our main point in putting our apparatus up is to study the trapped radiation. Now we are getting quite a lot of measurements of trapped radiation. Unfortunately, for every measurement we get, this means that the solar detectors don't get a measurement because this trapped radiation is interfering with it. So they just have to analyze their data and actually sort through so as to select periods in which there is no trapped radiation or negligible trapped radiation hitting their detectors. So although this is a nasty thing in that it reduces the total percentage of time that we are effective, although I use that word "effective" in a little bit of a dubious way. I think they are always effective, although the trapped radiation does reduce the time of measurements, nevertheless they still have times of measurements, just a smaller amount.

MR. NEWELL: To pick this point up further, you raised the question by saying. "It was put up and it is not successful." You recognize that the orbit of this satellite is eccentric and there are portions in which the equipment is below the radiation belt enough to get the data they were after originally.

They just haven't worked out this part yet. When they do they expect they will have what they were first after. But now in addition they are getting information on the radiation belt, in particular, since the ionization chamber continuously picks up these radiation belt particles when it is in the belt, it will give you quite a bit of information on the structure of the inner part of the radiation belt. So if you want to look at it another way, this is being more successful than we had expected.

QUESTION: I didn't mean to be critical. I just meant it was one of the first things we were going to put up.

MR. NEWELL: It had a long history of putting it up.

QUESTION: What do you mean by getting information of the structure?

MR. NEWELL: You see, if it is recording the radiation belt particles, as long as it is in the radiation belt and drops down to a different counting rate as the satellite comes out of the radiation belt, this then, you see, will give you the location of the lower edge of the belt. If you have this over a space of time, you have some interesting information.

MR. THOMPSON: This also gives you some look at some low-energy radiations which are not picked up by the van Allen counters.

MR. O'BRIEN: I might add that we can't lose from those, because Dr. Pomerantz and Dr. Schwed are measuring this for us with their detectors and some of the Naval Research Development people. So we are quite happy even though a little bit apologetic that things are confusing; they are issues.

MR. ROSEN: We have got to move a little bit faster.

MR. LA GOW: I will report on the status of the micrometeorite and the erosion experiment. This experiment is conducted to evaluate some of the hazards in the space environment . It consists of three evaporated cadmium sulphide conductors which are covered with thin but optically opaque films. The erosion of these surfaces by either high velocity molecules or impacts from micrometeorites would produce openings in the covers. The admitted sunlight would change the electrical resistance in the cell in proportion to the area of the hole.

Analysis of the telemetered records to date are incomplete and an examination of selected records from the first months show the following:

1, that approximately one-half of 1 percent of the area of one cell was admitting sunlight. This puncture occurred during the launch phase and hence is not expected to be from a micrometeorite. No further penetrations or erosions have been noted to date. The telemetry equipment in the cell, and the temperature sensor, to measure the temperature of one of the cells, has functioned properly.

This experiment was telemetered on the 108 Mc tracking transmitter which was last tracked on December the 4th this year when its chemical batteries were exhausted.

QUESTION: I wonder, would you clarify that one-half of 1 percent. Did you say one-half of 1 percentof the --

MR. LA GOW: Of the total area of one of the cells.

QUESTION: What size would that be?

MR. LA GOW: The cell is 3 millimeters in diameter.

QUESTION: What do you suppose that --

MR. LA GOW: Very small.

QUESTION: What do you suppose that puncture could have come from?

MR. LA GOW: I don't know, yet.

QUESTION: Well, I know you don't know, but is there any wild idea or theory on this launch phase?

MR. LA GOW: The reason I say I think it's associated with the launch phase is because it happened so quickly after launch and there not being subsequent punctures. It could have been a dust particle from the vehicle, possible.

MR. ROSEN: We move on to the next one.

MR. LA GOW: Next, I would like to call on Mr. Arthur Thompson from ABMA to report on the uncovered solar cell operation.

MR. THOMPSON: I would like to point out that I am not personally the sponsor of this. It is really a group sponsorship, ABMA and some of the people from Fort Monmouth Signal Corps Agency. The objective of this experiment was to determine the effect of space environment on unprotected solar cells. The results so far on the objective of this has indicated that the cells are operating properly after ten weeks of operation in the unprotected space above the earth. However, you have got to point out here that the apogee of this satellite is about 673 miles, this is below the, say, the lower radiation belts as they are described generally. Of course, we have lower energy ones as we note from the NRL experiment down to where we are, but the cells themselves are not being exposed to the high energy particles that are trapped in the radiation belts, so what we are doing is actually proving that the micrometeorites, after ten weeks, haven't seriously affected the cell.

It will take an experiment on a satellite which goes to a much higher altitude to determine the effect of radiation.

That is all I would have on that.

MR. ROSEN: Bill?

QUESTION: You mean that the quartz crystal window that we have used or are using for the protected cells also offers protection against radiation as well as against micrometeorites.

MR. THOMPSON: Yes.

QUESTION: By about what factor? I mean how much does it reduce the energy level?

MR. THOMPSON: Brian, could you or Dr. Newell handle this one?

MR. O'BRIEN: I think the point we have to consider here is that damage can arise through discoloration which will absorb out the light which wants to get into the cell to generate the electricity. You can also change the surface if you bombard it with particles. This is being done in the laboratory.

MR. ROSEN: This is the carbon-base plastic?

MR. O'BRIEN: Quartz. In an unprotected one, if you expose it to intense radiation, then the surface radiation damage, where radiation is possible, there is possible radiation damage.

QUESTION: Haven't the Soviets also sent up some with unprotected cells and haven't they found them to be operating, or operating quite well?

MR. THOMPSON: I will take that one. Yes, they had one on Sputnik III which lasted something like two months -- let's put it this way, the report that we got says that it was still going properly something like two months; however, they have the same problem that we have, their apogee was something in the order of 1,200 miles but it didn't stay -- of course, that is in the radiation belt, but it didn't stay there very much of its lifetime, so three months of operation or so still doesn't indicate very many hours in the radiation belt.

MR. ROSEN: The perigee of Sputnik III was 135 miles and the apogee was 1,167 miles.

QUESTION: So, for the time being I presume we will go on protecting the cells we are relying upon for power until we get some additional data that will indicate we can save that weight.

MR. THOMPSON: Satellites which have to penetrate the radiation belts.

QUESTION: The apogee of this, most of the life has been at what altitude, around 700?

MR. THOMPSON: You are speaking of our satellite?

QUESTION: Yes.

MR. ROSEN: 673.

MR. THOMPSON: Is the apogee.

MR. ROSEN: John?

QUESTION: Let me ask a confused question here. What is the distance of the inner and outer radiation belts and I don't see that you are going through them. How are you making measurements here?

MR. O'BRIEN: I think I had better draw a picture here.

This is going to be an extremely rough picture. We have the earth; we have the North and South Poles, as so; we have essentially what we call an inner radiation belt somewhere in there, in general about the equator, at varying altitudes at about a thousand kilometers average something of this order. We have the outer radiation belt which comes around like so in the form of horns. The distance here in miles varies between, say, 300 and 700 miles, depending on which side of the earth you are on.

QUESTION: Distance between what?

MR. O'BRIEN: Distance from there to there.

QUESTION: That is somewhat lower than the earlier figures of about 2,000 miles, I believe, wasn't it?

MR. O'BRIEN: Well, you see this nasty point here, this depends upon the magnetic field and your magnetic field is displaced from the center of the earth, the center is further out on the one side of the earth than it is on the other side.

In this satellite at a thousand kilometers -- call it 600 miles -- we are picking up quite strong inner zone over Johannesburg and over San Diego.

QUESTION: At 600 miles, you say?

MR. O'BRIEN: Yes. This is right up near the limit, though. This is up near the apogee. This is our outer zone which more or less filters down in gradually decreasing intensity. Of course, what I have drawn here are the regions of maximum intensities and you have fringe ratings going on, you gradually come down. This is why earlier I drew curves of intensity versus position which went like that rather than like that and like that.

Okay, we have got these fringe regions. Now the satellite at present is somehow or other cutting like so. This is very, very rough, but the important point here as far as the unprotected solar cell is concerned is that it spends quite a deal of time in these regions and a little bit up here outside the most intense radiation zones.

QUESTION: What is the distance out from the earth's surface of the outer?

MR. O'BRIEN: This one, 28,000 kilometers; call it 15,000 miles.

QUESTION: Fifteen?

MR. O'BRIEN: 15,000 miles, yes.

QUESTION: And then it is --

MR. O'BRIEN: It stretches right down here to altitudes of only a couple hundred miles.

QUESTION: Your satellite is cutting through the horns.

QUESTION: What is the center of the outer belt from the earth's surface?

MR. O'BRIEN: Sorry. The figure I gave was actually from the center of the earth. Do you mind the center of the earth?

QUESTION: Or surface.

MR. O'BRIEN: The surface of the earth, it is around 12,000 miles.

QUESTION: But the horm comes down to about 200?

MR. O'BRIEN: The horn comes in here, yes, into there. We often talk about this as being the equatorial region because the earth's magnetic field curves in the same way.

QUESTION: These are the magnetic poles you have shown here. When did we discover that the center of the earth's magnetic field does not go through the center of the earth?

MR. O'BRIEN: The magneticians on the surface of the earth discovered this quite a long time ago. They have been trying to fit their measurements to a given form in here. Some cosmic ray observations have reinforced this and the fact that you get this inner zone at different points is a further evidence. It is by no means the only evidence.

MR. THOMPSON: The Argus experiment demonstrates it.

MR. O'BRIEN: The Argus experiment was another demonstration of this because the Argus went further out on the one side than the other.

QUESTION: You say it is 12,000 miles. Then how far out does the second belt extend?

MR. O'BRIEN: This is the one in which the actual displacement of this magnetic bar, if you like, is a couple of hundred miles, you see, and then this couple of hundred miles is added to --

MR. ROSEN: That is 650.

MR. O'BRIEN: The order of magnitude 300 to 500 miles or upwards of that, actually.

MR. NEWELL: Wasn't the question how far out --

QUESTION: I am trying to find out how thick the outer belt is.

MR. O'BRIEN: Well, this varies with solar activity. I am sorry. I thought you were talking about this. Two space rockets have shown different thicknesses here. One came right out here somewhere and the other one came in, and the Explorer VI observations actually sampled out here, too, and they are giving very useful information about this.

QUESTION: How far are they? What is the thickness? Does it go out to 35,000 or 50,000?

MR. POMERANTZ: They went to something like --

QUESTION: Mr. Van Allen says it goes as far as 50,000, but with fluctuations depending on solar activity.

MR. NEWELL: That is right.

MR. O'BRIEN: I think one can't lay down rigid limits on this because you have to define what you mean by the belt at first, and I said there are very extensive fringe regions.

QUESTION: How would you describe the path of this satellite with regard to the two radiation belts in general?

MR. O'BRIEN: Very, very roughly, that is it there.

QUESTION: What I mean is would you consider that as putting the satellite through the major portion of the inner belt and at least the fringe portions of the outer belt; how would you describe it?

MR. O'BRIEN: I don't think it stretches really into the heart of the inner zone, the inner belt here. But we are still a little bit uncertain about this. We don't quite know where that is either.

MR. NEWELL: I wonder if I could drop in a few illustrative words here. The problem of the radiation belt is rather confused because of the fact that you have a wide range of particles, a variation with time. By way of analogy, if you were to look at the sun's visible light through a red piece of glass, things would look red, you just see red. If you look at it with a green piece of glass, you see the green; and yellow, yellow; and so on.

In the same way here, if you look at the radiation belt with equipment that can detect nothing below a hundred Mev, for example, particles, then you will see one structure for the radiation belt. If you look at it with other equipment that can see in a different range, then the radiation belt will look different again. And if you look at it with, let's say, equipment that can go down into the kiloelectron volt range or lower, you will get an even more difused picture of the radiation belt. But with that qualification I would think you could say we have seen that the radiation belt and all its complexity extends out to maybe 50,000 kilometers. Wouldn't you say that is right?

MR. O'BRIEN: Yes.

MR. ROSEN: Any more questions?

Fine. This is our last presentation.

MR. LA GOW: We have one more presentation here. Mr. Josef Boehm of the Army Ballistic Missile Agency will summarize for us what the mechanical problems encountered in devising this satellite were.

MR. BOEHM: Explorer VII was engineered to serve as an orbital carrier for seven scientific experiments which we have just studied.

It was a very challenging engineering task to incorporate the great number of requirements into one mechanical and electrical system. The complexity of the system, the applied technology with respect to a microminiaturization and the light weight design make this carrier the most efficient and sophisticated satellite of longest lifetime which was ever placed into orbit by the United States so far. But despite the apparent complexity, great effort went into establishing a relatively simple and clear layout which now guarantees exact and unbiased measurements.

I shall point out a few of the essential development phases.

The design development of the satellite was greatly influenced by a series of requirements which resulted partly from the specific mission and partly from the applied booster system which we had to use and which we used. The most conspicuous requirement given by the mission was that the tumbling of the satellite had to be avoided in any case.

Fortunately we can say that telemeter data so far indicates that the satellite is fine, keeping its attitude, and there is no trace of tumble noticeable. The fact to shape the satellite in such a way that the satellite maintains the attitude of the spin axis was the greatest influence to the shape the satellite finallyobtained.

We needed a disk-shaped mass distribution, a disk-like mass distribution of suspended stabilized body.

The shape of the satellite was in addition determined by providing suitable attachment possibilities for the elements of the different experiments and to have sufficient area for the solar cell areas.

Quickly I would like to go over the configurations. You have those which Mr. Heller showed with his photography. The satellite itself consists of a truncated double cone, joined by a cylindrical center ring.

It is thirty inches long and 30 inches wide at its equator. The instrumentation is assembled in modules of six inches in diameter and of varying thickness.

The assembled modules have a column located around the spin axis. Iwould like later to make a sketch of it.

The desighers of the satellite had further to consider traces which occurred through the thrusts and the centrifugal forces. We have spin. The thrust as you know of the configuration has 450 rpm spin. We had to consider a great variety of vibrations. We had to see that the eddy currents were minimized as much as possible because the body is spinning in the earth's magnetic field.

The special problem was the selection of the material for vacuum condition. We had to introduce as a result of design quite a number of changes going into quite a number of different kinds of material.

And the last point I would like to mention, which was explained by Mr. Heller, the influence of the temperature control to the design. There was quite a lot of cooperation required in order to achieve the temperature control.

The total weight of the explorer VII was 92.3 pounds at launching. I have here a breakdown of the components which I shall just quickly read.

The structure of this 92.3 pound satellite weighed 29.6 pounds. The instrument package, 14.4; the battery supply, 15.9; solar cell arrays 18.2; separation decision, 2.8; the detectors and sensors, three pounds; balancing weights, .7 pounds; the antenna system, 108 mc. and the 20 megacycle antenna, 2.2 pounds, the other is 3.2.

Potting and wiring 1.1 pounds, and the surface coating paint .9 pounds. The sum is 92.3 pounds. The altitude requirement for the satellite made also the separation of the empty shell of the last stage motor from the satellite necessary.

Therefore, a separation device was inserted between satellite and the fourth stage. As planned, there was no dynamic disturbance caused at separation. The transistor communications systems employed two transmitters, one solar cell powered operations at 20 mc.

Both communications systems worked perfectly from the beginning. The 20 megacycle system went into operation after its antenna wires were unreeled and orbited to a diametral length of 24 feet. This happened right after separation of the last stage shell.

So far we have measured only a very small spin from the original spin. The spin as the last stage had been fired was reduced again by the change in the mass distribution due to the unreeling of the fullantenna as I said to 24 feet total length.

Now, the most important prerequisite for the success of Explorer VII was to establish an extremely high degree of reliability. This was achieved by subjecting the satellite and its components to a most comprehensive and severe test program which included all functional and environmental conditions or requirements.

Several prototypes of the satellite were prepared for mechanical, electrical and thermal test groups. Space conditions were simulated for the instrumentation by applying the temperature vacuum "soak" tests of long duration.

Just to see how the instrumentation would behave later in orbit, the separation of the last stage shell from the satellite was simulated to check the dynamic behavior during the process of separation.

Separation of the extent of 20 megacycles antenna system was tested in a special vacuum chamber.

After nearly two and a half months of successful operation of Explorer VII it can safely be stated that a remarkable progress in space technology is achieved. This was only possible with the solid teamwork which was performed at the Developments Operations Division of ABMA, the main load of the work being carried on by the Guidance Control Laboratory, and I would like to emphasize and mention here that I am just a representative speaking about the work and contributions many people have given to this project.

QUESTION: What is the spin rate and rpm?

MR. BOEHM: The original spin rate was normally 450 rpm of the cluster. And the spin rate went down to approximately 360 rpm at the beginning of orbiting when the antenna system was unreeled. We have now a small drop, let me say between 5 and 10 rpm, which means that the spin decay is a very slow process and we are positive we have sufficient spin-for-spin stabilization for the planned one year of operation.

QUESTION: What was it now, sir. I didn't hear what you said. What is the current spin rate?

MR. BOEHM: I know it was originally roughly 360 rpm; it went down to about 300.

MR. THOMPSON: It is about 350; 348 to 350.

MR. ROSEN: Are there any more questions?

QUESTION: I have one. In summing up I would like Dr. Newell or Mr. LaGow, or someone, to give us an overall summary of what the success of this is.

MR. ROSEN: Dr. Newell, would you reply for the gentleman?

MR. NEWELL: Well, I will attempt a summary. I may turn to Mr. LaGow to fill in some of these things.

The Explorer VII satellite, by way of summary has been successful in its design as you have heard from Mr. Boehm and Mr. Heller. The temperature control is working as it should; the temperatures for the instruments are within the proper ranges. The structure is as it should have been; the spin rates desired, mainly about 350 rpm, were achieved. The equipment seems to be working with the desired reliability, and we can hope that the satellite will operate for the full year that it is supposed to.

As to the scientific measurements, the equipment in this case is also working as it should, and in the case of energetic particles, the SUI equipment is operating properly, and there were three main phenomona observed. I will ask for three brief statements from the SUI man right here as to what those were.

MR. O'BRIEN: One phenomona was quite simply that we observed bursts of sporadic radiation on 20 occasions; another was that we observed a temporary center of increased radiation inbetween the two radiation zones, and this is an extension of Explorer IV work; and the third phenomona is that we have been able to push the study of the Forbush decrease to rather lower energies.

MR. NEWELL: Picking up with this, the energetic particles measurements include observations on the heavy particles in cosmic radiation; that means those that have an atomic number greater than 6. These measurements are divided into three groups, all of those greater than 6, all of those greater than 9, and all of those greater than 16. So that in effect by comparing these two measurements you can get those between 6 and 9, those between 9 and 16, and then those heavier.

Are there any other specific items you want to add?

MR. POMERANTZ: Well, the energy distribution of the heavy nuclei has been determined and the special distribution, the geographical distribution, has given data which is related to the effect of the earth's magnetic field on incoming charged particles, and fluctuations which have not yet been studied in detail. Temperature variations have also been observed.

MR. NEWELL: Thank you.

In the radiation measurements there is the NRL radiation experiment which refers to the solar X-radiations; these counters are operating properly and are obtaining data on the lower edge of the inner radiation belts, and presumably are obtaining the solar X-ray data that they were sent up for over portions of the orbit which have not yet been analyzed.

This is the reason I say presumably in connection with that statement.

In the case of the meteorological experiments, the Suomi radiation balance experiment, this equipment, too, is operating as it should. Something like five or six thousand measurements are being taken per day, of which from 10 to 25 percent are being read off at the recording stations. I will ask Dr. Suomi to add to this the main points obtained from his measurements.

MR. SUOMI: The main points for the meteorologists to analyze this enormous volume of data -- we have for the first time a look of a good aspect of the world's weather on a world-wide basis or almost a world-wide basis and while I did comment about a few details the real story will come with the analysis on a world-wide basis forlonger periods of time.

MR. NEWELL: Then picking up again we have the micrometeorite measurements, the indications from the equipment in the satellite are that micrometeorite puncture and erosion for the period of time that these observations were made is not a great engineering hazard.

This still leaves open the problem of what these effects may be over long periods of times, say for many years, and the plan is to continue such measurements in other NASA satellites.

I will ask Mr. Lagow if he has anything he wants to add.

MR. LAGOW: I think that covers it, Dr. Newell.

MR. NEWELL: Then I would like to make a general comment. You have now been hearing about an important and versatile satellite. You have been hearing from the scientists who are doing the actual experimenting.

It must be clear to you how much of a team enterprise this sort of thing is. Without a joint effort of many people such a satellite experiment or collection of experiments cannot get done.

Now the question naturally arises as to how this teamwork can be broadened. In particular, how can the participation of the scientific community be enlisted on the broader basis.

In this connection NASA would like to make the following announcements: the individual experiments on this team have made available to us the complete telemetry codes for their experiments and instructions on how to use them.

This material would make possible to scientists around the world who are able to record the telemetry data that they can reduce this data for themselves and participate in the experiments. We will proceed to assemble these telemetry codes and instructions and in the near future will be prepared to accept requests from scientists around the world, both in our country and in other countries, for copies of these telemetry codes and the accompanying instructions.

I think that winds it up.

MR. ROSEN: All right, ladies and gentlemen --

QUESTION: When you say in a position to accept requests -- is this an indirect way of saying you will send it out to any qualified scientist who asks for it or will there be exercised certain limitations?

MR. NEWELL: We will send it out to any qualified scientist who requests it.

QUESTION: On either sideof the Iron Curtain?

MR. NEWELL: Yes, sir.

MR. ROSEN: Anyone who can receive it.

QUESTION: Is there any particular area of the world where you are much more interested where you have a big gap where you would like to get scientists than in any other?

MR. NEWELL: I would like to ask the individual scientists to answer this question.

MR.ROSEN: Dr. O'Brien apparently has a few gaps.

MR. O'BRIEN: Well, these examples of gap, -- this is not intended to be a comprehensive list --

MR. ROSEN: Or an invitation?

MR. O'BRIEN: Japan we now have with the NASA station, we would like some in China, in the Soviet Union, in India, in the South Pacific, and this matter is being rectified, too, and also in the East Indies.

MR. NEWELL: Any others?

MR. SUOMI: I might add Central Africa.

MR. POMERANTZ: I would like to say Amen to that and to have as much coverage in the equatorial region as possible.

MR. ROSEN: What is in Central Africa?

MR. SUOMI: Nairobi.

MR. ROSEN: Any more questions?

QUESTION: I have one more question for Dr. O'Brien.

Presumably, Doctor, it is conceivable, isn't it, that during the remaining active lifetime of the satellite that these sporadic bursts that have occurred between the inner and outer layers, you get more records on them and is it conceivable that you will get something on the nature of these things to tie in with this question of whether or not they might be protons from the sun?

MR. O'BRIEN: Yes, indeed. This is one of the very great advantages of the long life of Explorer VII, because these are relatively rare phenomena and by, of course, extending the lifetime we hope to get more examples of them to help clear up some of the problems.

QUESTION: I do not know whether this is a question for Dr. Newell or for Dr. O'Brien. But when I was out at the University of Iowa maybe six or nine months ago, we had a lot of the early Vanguard and Explorer data but it was being processed manually with only a handful of people.

Here we spend great sums of money to go out and make these measurements and get the data and then we save a few pennies by not buying the modern data, handling and analyzing equipment on the market.

Have any steps been taken to speed up the reduction of the useful data from the raw data from the satellites.

MR. NEWELL: Let me take a crack at an answer to this.

This is a very serious problem because after all the data are the harvest of all your activity and also because it is a very costly phase; it is remarkable how expensive this can get when you sit down and begin to add up the dollars.

For this reason NASA has a committee right now of people concerned with this business working out a data acquisition handling and use plan which will involve the questions of the modern equipment, computers, and so forth, and their availability to the scientists to get this work done.

This committee does not have an easy job and we do not expect them to have a full answer for perhaps as much as half a year, so we expect to pick up partial answers for the individual satellites as we go along and we are already picking up answers for the satellites that are in orbits.

MR. ROSEN: Incidentally, Phil, just the cost of tape alone is running at $5,000 a month.

QUESTION: I appreciate these things are costly but the end result of all the expense is useful data and it would be a shame if buried somewhere in these tapes is some data that is of value but we would not discover it for another three years.

QUESTION: Is this invitation for participation that is going out to scientists throughout the world, is that for participation for Explorer VII only?

MR. ROSEN: Let'sfinish this one here.

MR. THOMPSON: I would like tomake a statement about this automatic reduction of satellite data. When one realizes the fact that you are pressing transmitter power, information rates, you have a lot of ground interference which you cannot control and all in all you normally get back signals which are, when reduced to paper are actually put on magnetic tape, are not of a quality that you can reduce with equipment.

We are in luck when we have passes of any duration that are suitable for automatic reduction, so --

QUESTION: I do not want to labor the point but girls were sitting out there with rulers, not even using these elementary tapes, pushing a button, having a punched card automatically fall out. Out there were one or two girls sitting there, miles and miles of tape and they were analyzing it, I guess, at about a foot per minute rate.

MR. THOMPSON: Our experience has been keeping this machine running that you punch the button on and which is just about as time-consuming as some of the reduction.

MR. NEWELL: It is not an easy problem and the answer is going to be individually tailored to individual situations and in some cases, in fact in many cases you will continue to have people with rulers and miles of tape to pick out spots and look at them.

In other cases you will use the machines when these work out best.

MR. ROSEN: I think the SUI representative would like to --

MR. O'BRIEN: No; my comment has already been stated.

MR. LA GOW: I would like to ask Dr. Suomi to make a statement to be used. He is planning to use a machine.

MR. SUOMI: The experimenter at the beginning of the experiment is naturally inquisitive about what's going on and you usually try to do things by hand because this seems the fastest. Then you reach the stage where you know you have to put it down because the data is piling up on you. Well, we have at Wisconsin a program to utilize the 704 which the Mid-Western Universities Research Association has there. The apparatus is set up to accept data at high speeds, approximately 512 times the regular play-back speed. This noise which has been mentioned is definitely a problem; it's almost as bad as trying to talk against this banging radiator we have had all afternoon. But there are some tapes, a large number, actually, which are very clear and these can be processed automatically. Moreover, this is a very challenging situation to engineers, and so on to eliminate the noise where it is possible, and this is being worked upon. We are very close, but we are not quite there. Perhaps in another month or so.

MR. ROSEN: Well, gentlemen, --

QUESTION: Would you answer that question about whether or not this invitation includes only the Explorer VII or all satellites that we have up there that are still operating?

MR. NEWELL: This is only Explorer VII; we have the telemetering codes from this satellite.

MR. ROSEN: We have ten more months of expected life to go.

MR. NEWELL: This same consideration will undoubtedly come up in connection with every satellite we put up, but will have to be handled in connection with individual satellites. Sometimes the whole problem of reducing the data and interpreting them properly without getting errors to creep in will mean that this has to stick with the scientists who designed the experiment and put it up.

QUESTION: Thank you very much.

MR. ROSEN: Thank you very much.

(Whereupon, at 3:30 p.m. the press conference was concluded.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

NASA RELEASE NO. 60-101
DU. 2-6325

For Release: Wednesday A.M.
January 13, 1960

MILTON B. AMES NAMED
DEPUTY DIRECTOR OF ADVANCED RESEARCH PROGRAMS

Milton B. Ames, Jr., has been named Deputy Director of the Office of Advanced Research Programs in the headquarters of the National Aeronautics and Space Administration. The office is responsible for advanced research in aeronautics and space conducted or sponsored by NASA. Ames was formerly Assistant Director of Research for Aeronautics and Flight Mechanics. The appointment to the new post was effective January 10.

Ames, a native of Norfolk, Virginia, was born September 21, 1913. He earned a Bachelor of Science degree in Aeronautical Engineering from Georgia Institute of Technology in 1936.

He joined the staff of the National Advisory Committee for Aeronautics, the predecessor of the NASA, as an aeronautical research engineer at the Langley Research Center in 1936. From 1941 to 1943 he was Engineering Assistant to the NACA Director at headquarters. During the following three years he was Engineering Assistant to the Chief of Military Research in Washington. In 1946 he was appointed Chief of the Aerodynamics Division and later became Chief of the Aerodynamics and Flight Mechanics Research Division when the NASA was established October 1, 1958. He was promoted to Assistant Director of Research for Aeronautics and Flight Mechanics May 12, 1959.

A Fellow of the Institute of the Aeronautical Sciences, Ames was chairman of the Washington Section in 1948-49. He is the author of a number of technical publications.

Mr. and Mrs. Ames and their children, Carol Diane 12, Linda Anne 9, and Milton Stephen 7, live in Fairfax County, Virginia.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

RELEASE NO. 60-103
Dudley 2-6325

FOR IMMEDIATE
RELEASE
January 13, 1960

UPPER STAGES FOR SATURN

The National Aeronautics and Space Administration and the Department of Defense have requested the Army Ballistic Missile Agency to initiate negotiations with industry within a month for upper stages powered by cryogenic propellants for the Saturn space vehicle.

The action follows approval by NASA of a Saturn development program recommended by the Saturn Vehicle Team composed of representatives of NASA, ARPA, ABMA, Department of Defense Research nd Engineering, and the Air Force. NASA assumed technical direction over Saturn under a NASA-DOD agreement of 18 November 1959 pending formal transfer of ABMA to NASA. (NASA Release No. 59-251)

The upper stages will be mounted on the Saturn 1,500,000 pound thrust booster under development by ABMA since August 1958. The booster is powered by a cluster of eight Rocketdyne H-1 engines using liquid oxygen and RP-1 propellants contained in nine tanks. The booster is scheduled for its first test flight in the 1961-62 period.

The Saturn development plan approved by NASA Administrator T. Keith Glennan calls for an initial vehicle of two or three stages depending on specific missions. It will be about 150 feet high in its three stage configuration.

-END-

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

JAN 16 1960

RELEASE NO. 60-102
Dudley 2-6325

FOR RELEASE
AFTER LAUNCH

SECOND NASA TEST LAUNCH OF 100-FOOT SPHERE

A second sub-orbital test flight of a 100-foot inflatable sphere was conducted today by the National Aeronautics and Space Administration from its Wallops Station, Virginia, launch site.

A test vehicle carrying the sphere was launched at 5:35 pm EST. It boosted the sphere to an altitude of about 250 miles. It traveled 490 miles east across the Atlantic Ocean.

The experiment was to continue test of:

- the mechanism for ejecting the sphere from its payload and inflating it in space
- the solid propellant third stage of the Delta vehicle under development in NASA's space vehicle program.

On October 28, 1959, a similar test was conducted from Wallops Station (NASA Release No. 59-237). NASA announced on December 2, 1959, that it plans to launch a 100-foot inflatable sphere into orbit early next spring for use as a passive communications satellite. The experiment will be called Project Echo (NASA Release No. 59-261) and will employ the Delta vehicle.

Today's two-stage launch vehicle stood 32½ feet high and weighed five and one-half tons at take-off. It produced an initial thrust of 130,000 pounds.

The first stage was one Sergeant solid rocket with two Recruit assist rockets to increase initial thrust. The second stage, originally developed for Vanguard, was an Allegany Ballistics Laboratory X-248 solid rocket which will be the third stage for the Delta vehicle.

The Delta will use a Thor IRBM first stage and an Aerojet-General liquid propellant second stage which has been used in the Vanguard and Thor-Able vehicles. Under development by contract to Douglas Aircraft Company, the Delta is scheduled to begin a variety of satellite and space probe missions for NASA in early 1960.

The 100-foot sphere was made of mylar plastic half a mil thick (half of one thousandth of an inch) coated with vapor deposited aluminum. It weighed about 130 pounds. The aluminum provided a high degree of reflectivity of light and radio signals.

At launch the sphere was folded into a round magnesium container 26½ inches in diameter. The complete payload package weighed about 190 pounds.

After ejection from the container, inflation of the sphere was begun by residual air inside it. Further inflation was accomplished by means of 30 pounds of sublimating powders carried in the sphere.

The payload did not carry a beacon transmitter for tracking but a telemetry transmitter on the second stage reported vehicle performance to ground stations at Wallops.

The 100-foot sphere was conceived by Langley's Space Vehicle Group headed by William J. O'Sullivan Jr. The sphere and vehicle were developed by Langley's Applied Materials and Physics Division, Joseph A. Shortal, Chief. Project engineer was Norman L. Crabill of AMPD. Leonard Jaffe of NASA Headquarters is chief of communications satellite programs.

-0-

HOLD FOR RELEASE UNTIL LAUNCHED

DEPARTMENT OF THE AIR FORCE
SCHOOL OF AVIATION MEDICINE
USAF Aerospace Medical Center
Brooks Air Force Base, Texas

JAN 21 1960

FACT SHEET

The School of Aviation Medicine, Brooks Air Force Base, Texas, was provided an opportunity to obtain additional biomedical research data through the use of a rhesus monkey in today's Little Joe test conducted by the National Aeronautics and Space Administration from Wallops Station, Virginia.

The monkey, named Miss Sam, is a 6-pound, 3 1/3-year old ________ ~~(male,~~ female) born and trained at SAM. It will be returned to SAM immediately after recovery to undergo extensive post-flight examinations.

The biopack container used in today's animal experiment was designed and built by SAM scientists and engineers. The 100-pound container is 36 inches long and 16 inches in diameter. Oxygen was metered from a tank through a two-stage reducer regulator. Interior temperature was maintained at a comfortable level by filtering body heat into a heat sink. Absorbent units took up excess water vapors and carbon dioxide and a small fan circulated the air.

Several miniaturized electronics devices were used to determine response to high accelerations and weightless flight. An ocularmotor, similar to spectacles, and fitted around the eyes, was used to measure disorientation and dizziness. This instrument picks up electrical impulses from eye muscles and relays them to a recorder.

A miniature electrocardiogram recorded the animal's heart activity during the flight. A device for recording respiratory movement was also included.

The monkey rode in a form-fitting couch lined with shock absorbent plastic foam. It faced skyward at liftoff so that acceleration forces would be from front to back. It also faced skyward on the descent.

The animal was trained to respond to a cue in the form of a small light. When the light came on it responded by moving a lever similar to an airplane stick. The number and frequency of such responses were recorded to determine the animal's ability to perform during various stages of flight.

- End -

HOLD FOR RELEASE UNTIL LAUNCHED

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

JAN 21 1960

FACT SHEET

ANNEX I
Item 1

FOURTH LITTLE JOE BOOSTER LAUNCHED

The National Aeronautics and Space Administration launched the fourth Little Joe booster as part of the Project Mercury development program at 9:23 AM EST today. The launching was conducted from the NASA Wallops Island, Virginia.

Todays flight was conducted primarily to measure performance of the Project Mercury escape system at the maximum airloads anticipated for an abort from an Atlas boosted Mercury capsule launching.

Secondary missions include (1) exercise capsule landing systems including the drogue and main descent parachutes, (2) employ helicopter recovery techniques and procedures utilizing elements of the US Navy Mercury Recovery Task Force.

In addition, the US Air Force School of Aviation Medicine will gather further basic biomedical information utilizing a rhesus monkey as a test subject.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

JAN 21 1960

FACT SHEET

ANNEX II
Item 1

For Release After Completion of Flight

Firing Sequence.- In today's flight, two Pollux and four Recruit engines were ignited to lift the booster from the pad. Burning time for the Recruits was 1.5 seconds, and for the Pollux engines about 26 seconds. Thrust at liftoff was a quarter of a million pounds.

When the booster reached an altitude of 36,500 feet, the escape rocket was ignited. Burning about one second, the powerful rocket lifted the capsule away from Little Joe booster at a rate of 200 feet per second. The capsule and tower coasted to an altitude of 48,900 feet, and the tower was automatically jettisoned by a timer mechanism. At 10,000 feet, the main cargo parachute deployed and the capsule landed in the waters of the Atlantic about 12 miles from shore.

The capsule will be taken to the Langley Research Center, and the rhesus monkey will be returned to the School of Aviation.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

FACT SHEET
JAN 21 1960

ANNEX II
Item 2

For release: When capsule is returned to Wallops

LITTLE JOE CAPSULE RECOVERED

The Little Joe capsule launched at 9:23 AM today by the National Aeronautics and Space Administration from Wallops Station, Virginia, was recovered 9:33 AM by a helicopter of Marine Air Group 26, New River, North Carolina.

Scientists will analyze data recorded on-board to determine the operation of the Project Mercury pilot escape mechanism under maximum airloads.

The condition of the animal carried on board to obtain measurements of the biological response to space flight has not been determined.

The capsule was retrieved from the water ~~six~~ 12 miles from Wallops and was transported to the launching site.

HOLD FOR RELEASE UNTIL LAUNCHED

DEPARTMENT OF THE AIR FORCE
SCHOOL OF AVIATION MEDICINE
USAF Aerospace Medical Center
Brooks Air Force Base, Texas

JAN 2 1 1960

FACT SHEET

The School of Aviation Medicine, Brooks Air Force Base, Texas, was provided an opportunity to obtain additional biomedical research data through the use of a rhesus monkey in today's Little Joe test conducted by the National Aeronautics and Space Administration from Wallops Station, Virginia.

The monkey, named Miss Sam, is a 6-pound, 3 1/3 year old ________ (~~male~~, female) born and trained at SAM. It will be returned to SAM immediately after recovery to undergo extensive post-flight examinations.

The biopack container used in today's animal experiment was designed and built by SAM scientists and engineers. The 100-pound container is 36 inches long and 16 inches in diameter. Oxygen was metered from a tank through a two-stage reducer regulator. Interior temperature was maintained at a comfortable level by filtering body heat into a heat sink. Absorbent units took up excess water vapors and carbon dioxide and a small fan circulated the air.

Several miniaturized electronics devices were used to determine response to high accelerations and weightless flight. An ocularmotor, similar to spectacles, and fitted around the eyes, was used to measure disorientation and dizziness. This instrument picks up electrical impulses from eye muscles and relays them to a recorder.

A miniature electrocardiogram recorded the animal's heart activity during the flight. A device for recording respiratory movement was also included.

The monkey rode in a form-fitting couch lined with shock absorbent plastic foam. It faced skyward at liftoff so that acceleration forces would be from front to back. It also faced skyward on the descent.

The animal was trained to respond to a cue in the form of a small light. When the light came on it responded by moving a lever similar to an airplane stick. The number and frequency of such responses were recorded to determine the animal's ability to perform during various stages of flight.

- End -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Von Braun To be [illegible] of N[illegible]

RELEASE NO. 60-106
DU. 2-6325

FOR RELEASE: Friday a.m.
January 22, 1960

NICHOLAS E. GOLOVIN NAMED DEPUTY TO ASSOCIATE ADMINISTRATOR

Nicholas E. Golovin has been appointed Deputy to NASA's Associate Administrator, Richard E. Horner. Before joining NASA, Dr. Golovin was Deputy Chief Scientist and Director of Technical Operations Division of the Defense Department's Advanced Research Projects Agency.

In his new post, Dr. Golovin will assist in the general management of the operations connected with NASA's space and aeronautical programs.

Dr. Golovin was born in Odessa, Russia, on March 18, 1912, and came to the United States in 1923. He earned undergraduate and graduate degrees in mathematics and mathematical physics from Columbia College and University. In 1955 he received his Ph.D. in theoretical physics from George Washington University. In addition, he is a graduate of the nuclear reactor engineering course at the Oak Ridge School of Reactor Technology.

After about eight years as a research statistician with R. H. Macy & Co., Inc., in New York City, Dr. Golovin entered Government service in 1943 as Chief of the Production and Requirements Analysis Section of the Tools Division, U. S. War Production Board. From 1944 to 1946, as an officer in the U.S. Navy, he served in the Bureau of Ordnance, the Office of Strategic Services, and the Naval Research Laboratory. In 1947 he became Associate Superintendent of the Electricity Division at NRL, and in 1948, was named Chief of the Management Planning Staff at the Naval Ordnance Test Station, Inyokern, California.

With the National Bureau of Standards from 1949 to 1958, Dr. Golovin served as Executive Assistant to the Director, Associate Director for Administration, and Associate Director for Planning. In March, 1958, he was appointed Chief Scientist at the White Sands Missile Range, New Mexico, where he was the principal scientific assistant and advisor to the Commanding General. In addition, he was responsible for the scientific and technical staff supervision over the work of the Range.

Dr. Golovin joined the ARPA staff in February 1959 as Director of the Technical Operations Division, responsible for the management of that agency's programs in military space technology and advanced research in ballistic missile defense and solid propellants. On September 1, 1959, he also became ARPA's Deputy Chief Scientist.

Dr. Golovin is a member of the American Physical Society, American Nuclear Society, American Rocket Society, American Association for the Advancement of Science, Philosophical Society of Washington, and American Ordnance Association.

Dr. and Mrs. Golovin (the former Lillian M. Wessells) have two children, Paul 7 and Carl 3. The family lives in Bethesda, Maryland.

- END -

NASA RELEASE NO. 60-106

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

NASA RELEASE NO. 60-108
DUdley 2-6325

FOR RELEASE:
Monday, 1 p.m. EST
January 25, 1960

Released jointly by NASA and British Information Service

U.S. AND BRITISH SCIENTISTS DISCUSS
COOPERATIVE EXPERIMENTS IN SPACE RESEARCH

During meetings held late last week at the National Aeronautics and Space Administration, scientists of the United States and Great Britain reached informal agreement on six experiments which the first joint U.S.-British Earth Satellite will carry.

The decision was based on an agreement in principle made last July between the two nations to unite in a cooperative scientific program of space research. This had followed a U.S. offer made through COSPAR to cooperate with other nations in space experiments.

The first jointly-sponsored satellite will contain these experiments: ion and electron studies by probes to measure electron temperature and concentration, and ion mass spectrum; electron density measurements; solar radiation studies; and primary cosmic ray measurements. These experiments were reviewed by COSPAR and then transmitted to NASA.

Organizational arrangements under which the joint project will be conducted were also made during the meetings last week.

Members of the working group and the project managers are now in the process of being selected.

The launching vehicle for the satellite will probably be the four-stage Scout rocket which is expected to be operational this year. Although no firm date has been set for the first joint experiment, it is planned for late 1961.

Representatives of the United Kingdom in the U.S.-British discussions were: Professor H.S.W. Massey, Chairman of the British National Committee on Space Research; Dr. A.P. Willmore, Department of Physics, University College, London; and Dr. H. Elliot, Department of Physics, Imperial College, London.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

RELEASE NO. 60-109
DUdley 2-6325

FOR IMMEDIATE
RELEASE
January 27, 1960

NASA COMPILES AERONAUTICAL DICTIONARY

The "Aeronautical Dictionary," compiled by the National Aeronautics and Space Administration, is now on sale at the Government Printing Office.

Written by Frank D. Adams, formerly in the Technical Information Division, the 199-page dictionary lists and defines about 4,000 aeronautical terms. No attempt was made to cover space technology terms unless they have aeronautical application. Space terms will be defined in a future NASA publication.

The aeronautical dictionary may be purchased for $1.75 from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

- END -

PROGRESS IN INTERNATIONAL COOPERATION IN SPACE ACTIVITIES

Hugh L. Dryden
Deputy Administrator
National Aeronautics and Space Administration

(Luncheon Talk, Institute of the Aeronautical Sciences,
Hotel Astor, New York, January 27, 1960)

INTRODUCTION

The purpose of this talk is to give you a progress report on the international programs of the National Aeronautics and Space Administration. Members of the Institute of the Aeronautical Sciences have long recognized the benefits of international cooperation in the aeronautical and space sciences. The IAS has been a strong supporter and active participant in international technical activities. I need only mention the preparation and dissemination of abstracts of scientific and technical reports published in other countries, the IAS contributions to AGARD, the Anglo-American conferences, and the International Congresses of the Aeronautical Sciences. Just last Sunday an IAS committee put the finishing touches on U.S. participation in the next Congress to be held in Zurich, September 12-16, 1960. Because of your past record of interest, NASA wishes you to become familiar with its international program and invites you to lend it your support and encouragement as appropriate.

It is clear from the language and legislative history of the National Aeronautics and Space Act of 1958 that cooperation with other nations in the scientific exploration and utilization of space was intended as an important and substantive obligation of the new civilian space agency. Some months after the Space Act went into effect, the staff of the House Committee on Astronautics and Space Exploration issued House Report No. 2709 on "International Cooperation in the Exploration of Space," from which I quote the following:

"The recent overseas studies made by representatives of the Committee have urgently reinforced these statements of aims, which should be differentiated from the standard expressions of goodwill accompanying so many international activities. For in this case the cause of international goodwill and the strictest considerations of the national self-interest are synonomous." (85th Congress, House Report No. 2709, page 2).

I agree heartily with this statement. We must establish international cooperation in fact as well as in name. We wish the programs to grow out of the joint interests of the U.S. and of other nations in space activities. We wish a true cooperation, not a hiring of scientists of other nations to carry out a program which we have unilaterally determined. We wish to share in the scientific and technical contributions which scientists of other nations can make, by providing them the opportunity for expression of their interests and capabilities in joint activities for the benefit of all mankind.

NASA OFFICE OF INTERNATIONAL PROGRAMS

In order to provide for aggressive support of international objectives within NASA, there has been established the Office of International Programs, headed by Mr. Arnold Frutkin, who was formerly associated with the programs of the International Geophysical Year. It is the function of this office to generate, to encourage, to coordinate, and to provide necessary supporting services for NASA's international activities. In so doing, close liaison is maintained with the Department of State through whom all formal international agreements are negotiated, and with other interested Federal agencies and committees, and with the scientific community. NASA consults and cooperates with the Space Science Board of the National Academy of Sciences and through it with the International Committee on Space Research (COSPAR) which continues the work in this sphere formerly carried on under the IGY.

METHOD OF PROGRAM FORMULATION

Within a very few months of its establishment, NASA was engaged in preliminary technical discussions with Canadian scientists on cooperation in space activities utilizing sounding rockets and satellites, and we were occupied with the problem of making permanent arrangements for the continued operation of Minitrack and optical stations which had been established in many countries during the IGY on a temporary basis. In March 1959, NASA authorized the National Academy of Sciences' delegate to COSPAR to offer, on behalf of the United States, to place in orbit individual experiments or complete satellite payloads prepared by scientists of other nations. This led almost immediately to preliminary discussions with scientists of the United Kingdom.

By the fall of 1959 there were reports that many countries in Europe were establishing or considering the establishment of national space committees. Accordingly, in September and October 1959, informal discussions were arranged abroad with scientists and officials of a number of European countries. These discussions were undertaken by myself, in company with Dr. Homer Newell, then Assistant Director for Space Sciences, and Mr. Arnold Frutkin, the Director of the Office of International Programs. The broad purpose was to acquaint NASA with the developing space interests abroad, and to offer to discuss possible cooperative programs if and when the space interests in each country became suitably organized and endorsed or supported by their governments or major scientific institutions. In each case, the group described (1) the organization of space activity in the United States; (2) NASA's desire for international cooperation in accordance with the Space Act; (3) the then current informal discussions of programs of cooperation with other countries; and (4) a desirable pattern of cooperation characterized by substantive contributions of instrumentation and services without exchange of funds. It was also stated that cooperative programs might ultimately be formulated at the diplomatic level, when required by reason of magnitude or content, but that in all cases technical discussions and agreement on an informal basis should precede formal governmental agreement. It was proposed that COSPAR be informed of the nature of any agreed programs, in order to gain the interest, constructive comment, and auspices of the international scientific community. Finally, our receptiveness to cooperation with groups of nations as well as single nations was indicated.

In mid-November an extensive discussion of a preliminary nature was conducted with Academician L. I. Sedov, President of the Soviet Commission for Interplanetary Communication, Academician A. A. Blagonravov, and V. I. Krassovsky during their visit to a meeting of the American Rocket Society in Washington. The Soviet scientists expressed interest in cooperation but stated their belief that such cooperation would have to proceed "step-by-step" from small beginnings. At that time they were willing to discuss only the UN Conference on the Peaceful Uses of Outer Space, proposed by their representative in the UN, then under discussion, but since authorized by the UN General Assembly.

STATUS OF THE NASA PROGRAM

The NASA International Program was formulated on the basis of these discussions and many other discussions between individual scientists. It comprises four basic types of activity: (1) Exchange of information; (2) exchange of personnel; (3) operational cooperation in tracking and telemetry; and (4) joint programs.

Exchange of Information. NASA continues in effect the practices in this area established during the IGY. Announcements of the launching of satellites and space probes are made routinely within a few hours through the press and through a special world communications net, AGIWARN. These announcements give orbital characteristics, payload weight, types of instrumentation, and experimental objectives. Preliminary and later results are published in the recognized journals and distributed also through the World Data Centers. These mechanisms have recently been reviewed and somewhat extended by a Working Group under the auspices of COSPAR.

NASA is participating extensively in scientific symposia, in many ways the chief tool for international scientific exchange. NASA scientists participated broadly in the recent COSPAR Symposium on Space Science at Nice and are scheduled in coming months to attend and contribute to meetings in Tokyo, Helsinki, Ottawa, Copenhagen, Madrid, Zurich and other cities abroad as well as here in the United States. Such meetings allow informal as well as formal exchange and establish the personal relationships indispensable to close and effective collaboration.

Potentially the most significant exchange may well occur at the prospective United Nations Conference on the Peaceful Uses of Outer Space. NASA is preparing to play a central role in organizing the U.S. contribution to this hopeful exchange of experience and knowledge.

NASA seeks not only to comply with but to go beyond the exchanges already agreed on internationally. Thus steps were taken recently to disseminate information to provide an opportunity to scientists in other countries to participate in U.S. experiments, utilizing their own scientific equipment. Thus the telemetry codes for Explorer VII are being furnished to scientists abroad on request for use with locally recorded telemetry. In this way additional data not otherwise available will be contributed to the total scientific results.

Advance notice has been given of Project Echo, the launching of a 100-foot inflatable, aluminized sphere which will serve as a passive reflector for communications experiments and which will also permit studies of atmospheric drag at great heights. With this advance information, foreign scientists may prepare the necessary equipment and arrange for such ground-based experiments as are feasible. Such advance notification will be given of future experiments when appropriate in the interests of broad participation, maximum utilization, and benefits for all.

Exchange of Personnel. A most effective way of exchange of information and experience is through exchange of scientists. Space science, for example, is not a new scientific discipline but rather the use of the new tools, sounding rockets, earth satellites and space probes, by physicists, astronomers, biologists and other scientists to advance knowledge in their own fields, and in broad problems requiring an interdisciplinary approach. Exchange of scientists may be used to provide training and for joint participation in cooperative programs.

In order to provide an opportunity for scientists from other nations to develop their interests and capabilities for space research, NASA has through the National Academy of Sciences established a number of postdoctoral and senior postdoctoral research associateships at its own laboratories. These associateships provide stipends beginning at $8000 per year. While open to U.S. as well as other nationals, thus far five scientists from other countries, Japan, India, New Zealand, and Denmark, have been accepted.

Exchanges of scientists will also occur in connection with joint projects. However, at this stage in the building of U.S. teams, considerations of operating efficiency require that some discretion be used in the acceptance of personnel for training. Discussions are in progress with several countries.

Operational Cooperation. NASA's tracking and telemetry operations in other countries now include (1) the Minitrack (radio) satellite tracking stations established during the IGY in connection with Project Vanguard; (2) the Baker-Nunn (optical) stations established by the Smithsonian Astrophysical Observatory for the same program and now operated for NASA under grant; and (3) services provided by observing stations of other countries under grant or contract. In addition, these operations will include (4) a new radio tracking net required for Project Mercury, the manned satellite project, and (5) a deep space probe tracking network consisting of the present NASA-JPL Goldstone station and two additional steerable radio "dishes" each 85 feet in diameter.

The existing radio and optical stations constitute an international tracking range based in ten countries. In Australia, India, Japan, and South Africa the stations are manned entirely by nationals of the host country. In Chile, Ecuador, and Peru the operation is a joint one. The stations in Argentina, Iran, and Spain are operated by NASA. New Minitrack stations are planned for Canada and England, subject to the approval of their governments.

The basic network abroad is supplemented in three instances by contract or grant arrangements. Thus, the largest steerable radio "dish" in the world, at Jodrell Bank in England, has contributed invaluable tracking services, and during the past year has been supported by NASA contract. Grants for tracking and telemetry services, together with necessary special equipment, have gone to the University of Heidelberg in West Germany and to the Radio Research Laboratories of Japan.

At the present time, NASA is in the process of establishing the Mercury network using some existing stations but requiring seven new sites. Negotiations conducted by the Department of State and NASA are in various stages of completion with Australia, Bermuda, the Canaries, Canton Island, Mexico, Nigeria and Zanzibar. At least two of these are expected to be operated by nationals of the host country.

In all, nineteen countries or political entities are involved in these network arrangements. NASA intends to encourage participation by qualified nationals of the country in which the station is located to the fullest extent practicable. The global nature of these NASA activities helps to broaden scientific interest, participation, and contribution in the exploration of space.

Joint Programs. A further step in international cooperation is joint participation in the design of experiments and in the preparation of payloads for rockets, satellites and space probes. Two projects of this type have been established, and discussions between NASA scientists and their colleagues from many other countries are under way.

As previously indicated, NASA's present philosophy is that proposals by scientists of other countries should grow naturally out of their own interests and capabilities. So that we may avoid problems of screening competing proposals in the same country and gain assurances of national support, it is desirable that they enjoy the sponsorship or endorsement of the governmental bodies or major scientific institutions concerned, as appropriate. Each nation will make and finance its own scientific and technical contributions in truly joint efforts with the U.S. towards mutually agreed objectives.

Agreement has been reached with Canada, represented by the Canadian Defence Research Board, on a joint project to sound the ionosphere from above by means of apparatus carried in a satellite. Canadian scientists are developing a sweep-frequency topside sounder and will provide the antenna and satellite shell. Meanwhile U.S. scientists will develop a fixed-frequency sounder. Both will be placed in orbit by the United States, the first flight, sometime in 1961, going to the instruments which are first available. This project is suitable for participation in ground observations by scientists of many other nations.

In July, the United Kingdom sent a team under Prof. H.W.S. Massey to discuss a British proposal within the framework of NASA's offer to COSPAR. It was tentatively agreed that British scientists would instrument perhaps three satellites for launching over a two- to four-year period by means of NASA's Scout or other vehicle. Agreement was reached last week for the experiments to be flown in the first Scout in the summer or fall of 1961. The experiments fall in the fields of solar radiation, ionosphere, electron density, and cosmic radiation.

The organization of space interests in other countries is in the early stages and programs have not matured. However, in addition to the U.S., USSR, U.K., and Canada, six other countries, Australia, Belgium, France, Italy, Japan, and Sweden have established national space committees. Because of the very substantial budgetary requirements of the more ambitious space programs, there is wide interest in international cooperation.

Interest has been expressed to NASA by the countries just mentioned and by scientists on behalf of Argentina, Israel, New Zealand, Spain and West Germany as well. The interest has been both formal and informal and includes requests for information exchange, for supplying sounding rockets, for exchange of scientific personnel, and for joint preparation of instrumental satellites for launching by the U.S. Formal proposals have been received from Australia, Italy, Japan, New Zealand, and West Germany, in addition to Canada and the United Kingdom.

SUMMARY

NASA's statutory obligations and operational requirements lead to a wide range of international activities and programs. These activities have generated wide interest and hold promise of increasing international cooperation in the exploration of space. NASA has taken positive steps to foster international cooperation in data and information exchange, exchange and training of scientific personnel, tracking and telemetry from spacecraft, and other ground-based participation, and finally joint projects. Substantial progress has been made, and some of the fruits of this effort should become apparent within the next few years.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

FOR RELEASE UPON
PRESENTATION:
Approximately 10 a.m.
January 27, 1960

Statement by

Dr. T. Keith Glennan, Administrator

National Aeronautics and Space Administration

before the

House Committee on Science and Astronautics

January 27, 1960

Mr. Chairman and members of the Committee:

I appreciate this opportunity to discuss NASA's program and its $802,000,000 budget appropriations request for Fiscal Year 1961.

The continuing interest in our program shown by the individual members of this Committee has been stimulating and gratifying. I have had the personal privilege of accompanying several members on visits to our Research Centers and to test launchings at Cape Canaveral. And all who have made these visits have expressed sincere gratification at the quality and dedication of the men who are carrying forward the Nation's space exploration program.

Before entering upon a discussion of our budget request and program, I want also to express publicly my appreciation for the effective support given to our operations by the several military services and by the Office of the Secretary of Defense. Cordial and effective working relationships have been developed during the past year and I am confident that the means now exist, or are in the process of creation, that will further minimize duplication and encourage even more effective mutual support in this difficult but exciting business.

As you know, the President recently directed me to study the possible need for additional funds to accelerate the high-thrust launch vehicle program. As soon as this study has been completed, we will be requesting substantial additional funds.

The fiscal year 1960 budget appropriation was $500,575,000. If the pending $23,000,000 supplemental request is granted by the Congress, the fiscal year 1960 total will be $523,575,000.

Several members of our administrative and technical staffs will follow me with a detailed, program-by-program review of the $802,000,000, fiscal year 1961 budget request in the following three principal categories:

...Salaries and Expenses: $167,560,000

...Research and Development: $545,153,000

...Construction and Equipment: $89,287,000

I would like to discuss with you some of the pertinent facts about the Nation's program in space exploration as I see them today. In doing this, I will start with an evaluation of our position with respect to that of our competitor in this business, the Soviet Union. Then I would like to point out the major events in NASA's operations over the past year and outline the course we must follow if we are to gain for the

United States the advantages that accrue to a nation demonstrating leadership in the science and technology which must undergird a program in space exploration.

It is clear that the Soviet Union continues to hold a substantial space lead in the eyes of the world. It is equally clear that this lead is based principally upon the possession by the Soviets of one or more reliable launch vehicle systems having perhaps twice the thrust of our own first stage booster rockets. This imbalance will continue until we have achieved a launch vehicle system that fully exploits the thrust of the Atlas through the construction and use of properly proportioned new upper stages, or until we have achieved a launch vehicle system which is based on a much more powerful first stage rocket -- or both. In no other aspect of the space business do we appear to lag the Soviet Union. In all other aspects, it is my opinion that we have an equal capability and that we have published more significant scientific results, more fully and more promptly than they.

This is a simple, straightforward statement. Like most such comparisons in the international scene, it is not subject to rigorous proof but my statement coincides, I believe, with the informed opinion of the scientific community at home and abroad. But this statement does not tell the whole story. The more powerful Soviet launching vehicles make possible their undertaking of some missions that are completely denied to us today. They are able, I should think, to move more quickly from the inception of an idea to the design and construction of payloads because weight restrictions are less stringent than ours. Thus they can avoid the time-consuming tasks of miniaturization, optimum packaging and other weight-saving practices. It is probable, also, that the availability of high-thrust launch vehicles operates to increase the reliability of their flights, since they can undertake significant and spectacular missions with adequate weight-carrying capacity permitting substantial margins for their operations.

You may properly say: All right, that was the situation a year ago. What have you done about it? Gentlemen, we have done a great deal. As my associates describe in detail our activities in the vehicle development field, you will see the effort that has been expended, the progress made, and the plans and promises for the future.

I am sure you are concerned, as I am, about the very long periods of time required for most of these significant development programs. It would be easy to promise earlier dates. Many people do. But I call your attention to the history of the Atlas ICBM. Almost five years of intense, top priority effort -- an urgent program in every sense of the word -- had to be expended to bring that rocket to an operationally ready state. And the launch vehicle systems we are developing are more complex and versatile than the Atlas.

I think it is time that all of us recognize that on the basis of the present "scoring" system, one based almost wholly on weight-propelling capability, we cannot expect to outscore the Soviets for a considerable period of time. We should be able to match their present weight-lifting capabilities within the next twelve to eighteen months, based on present expectations for the Atlas-Agena B and the Atlas-Centaur systems. If by that time, as may well be possible, the Russians have made optimum use of what we believe to be their present thrust levels, or have developed an even higher thrust booster, our expectations of superiority will not be satisfied for about four to five years, when the Saturn should be ready.

But we have used, to maximum advantage, the cards we have held in this game. Without desiring to play down our very real deficiency in thrust, I would like to cite an example. I think it is clear that we have made excellent use of launch vehicles utilizing rocket engines which were originally designed and developed for the armed services' missile program, not for space missions.

Out of 10 attempts to place spacecraft into orbit or on deep space trajectories in calendar year 1959, we achieved five successes. These, together with earlier Explorers, Pioneers, and Vanguards, have given us -- and we in turn have given the world -- a vast amount of data from which significant scientific information has thus far been derived.

As I have said earlier, in the extent and quality of our scientific findings we probably have an edge, in the judgment of the international scientific community. But the fact remains that novel and spectacular space experiments involving heavy and complicated payloads on difficult missions are the big chips in this poker game at the present time. As one newspaperman has said: "It is not good enough to say that we have counted more free electrons in the ionosphere than the Russians have, that we know more about cosmic rays. We must achieve the obvious and spectacular, as well as the erudite and obscure."

There is only one way to regain the ground we have lost -- ground lost several years ago. It will be accomplished by the establishment of hard-headed, long-term goals (this we have done); the identifying of the technical tasks necessary to be undertaken in order to press forward those goals (this we have done for the shorter term future); the development of the organization and management to accomplish these tasks (this we are doing); the utilization of the genius and capabilities of industry, education, and other branches of government (this we are doing); and the funding, at an adequate level, of the work to be undertaken (this we seek in the authorization request now before this Committee for study and action). All these elements must be pursued diligently, urgently, relentlessly.

At the end of the present fiscal year, the National Aeronautics and Space Administration, with the support of the Congress, will have organized under one governmental agency what I believe to be the greatest collection of scientific and technical personnel ever assembled, to carry out vigorously this Nation's space exploration program. With the help and genius of American industry, the proven talents of Dryden, Horner, Pickering, Silverstein, Abbott, von Braun, Newell, Hagen, Stewart, and hundreds of others, will meet with confidence any competitive challenge in space that this Nation faces today or that may arise to face us in the future.

As responsible officials, each of us can recognize that space is but one of the areas of intense rivalry between our way of life -- freedom -- and the Communist dictatorship. As individuals, we do have a responsibility to recognize that while space is the most glamorous, the most visible area of competition -- and very fruitful also for propaganda purposes -- we are engaged in an across-the-board contest. I remind you of this because these other areas of competition also make large demands on the public treasury.

Now what are our plans for the future? We seek $802,000,000 in new obligational authority. Before many days have passed this amount will be increased as we turn on more steam in our super booster program involving Saturn, its component rocket developments, and the F-1, 1,500,000-pound single chamber engine. Our intent here is to advance, as fast and as surely as the technological problems will permit, the time period in which the two-stage and three-stage Saturn vehicles will be available for initial tests and the time period in which we will have a reasonably reliable launch vehicle system in the multi-ton payload range. This program will be described for you by Dr. Wernher von Braun later in this series of presentations. The speed-up we hope to effectuate promises to be as much as one year for the complete first phase of the Saturn vehicle. The test dates referred to for the two- and three-stage developmental Saturn units will be advanced by three to nine months by the actions we expect to take.

Despite many expected problems, Project Mercury continues to move forward in an atmosphere of confidence apparent to all concerned. Morale is high, hours are long for the top staff, the Astronauts are busy and fit. In the third quarter of calendar year 1960 we expect to embark on the man-carrying, Redstone-boosted ballistic training flights. The first manned, Atlas-boosted orbital flight should take place in calendar year 1961.

The Atlas-Able flight to the vicinity of the moon, which was attempted on Thanksgiving Day last, will be repeated during the second quarter of calendar year 1960. A back-up booster has been scheduled for this flight,but a word of caution is needed here. Pad availability and check-out time required make it highly unlikely that a repeat mission can be scheduled within four weeks of first launch, should such a back-up flight be necessary.

Our experiments in space science and applications are scheduled at the rate of almost one per month for calendar year 1960. The Tiros meteorological payload; Project Echo, the passive communications satellite; and the several flights intended for the study of radiation and other phenomena of outer space, will keep our launch teams and scientists very busy. It is of interest to note the participation of one of the Nation's largest communications companies in the Project Echo experiment, with an investment totalling several millions of dollars of its own funds.

Consistent with our determination to hold to a minimum the number of different types of launch vehicle systems, we recently cancelled the Vega Project in favor of the Atlas-boosted Agena B vehicle. We canceled Vega for a number of reasons. First, the Defense Department's demonstration of significant reliability in the Thor-boosted Agena A system; second, the decision of the DOD to up-rate the Agena A stage to a point where it approached the capability in most missions, of the Vega; third, the high rate of firing of the Agena systems using both the Thor and the Atlas as first stage boosters, thus promising greater reliability; and fourth, the fact that the Atlas-Agena B availability approximates that of the Vega. All of these considerations entered into our decision.

The decision to cancel Vega was made with probable cost expenditures,including termination costs,running in the neighborhood of $17,000,000. Some portion of this expenditure is recoverable in the Centaur program. Schedules will not be delayed by this change in vehicle systems.

Organizationally, we have made good progress. The President's decision to give NASA full responsibility for all super boosters made it desirable for NASA to acquire the Development Operations Division -- the von Braun team -- from the Army Ballistic Missile Agency at Huntsville, Alabama. The President's report and supporting papers dealing with this transfer now lie before the Congress. Negotiations to effect this transfer have been carried out in a highly cooperative atmosphere of good will, and I am confident that the needs of the Army for support of specific military tasks will be met.

The acquisition of the von Braun group has made possible the beginning of centralization at Huntsville of major responsibility for the bulk of our launch vehicle systems development and operations. A new division of the NASA headquarters organization, the Office of Launch Vehicle Programs, has been established evidencing the importance we attach to this activity in which our budget estimates show more than $250,000,000 to be obligated during fiscal year 1961. Subsequent speakers will discuss our organizational arrangements in more detail.

Construction of Goddard Space Flight Center, named for America's rocket pioneer, is proceeding on schedule at Greenbelt, Maryland. Initial occupancy is planned for mid-1960, thus beginning the consolidation of our Washington area staff engaged in space flight development and field operations.

In the field of international cooperation, we have made very great progress. Here our policy of frankness and our adherence to the traditional and well-understood policy of prompt disclosure of scientific results is building good will throughout the world. Agreements with several nations have been negotiated covering the installation, manning, and use of tracking and data acquisition equipment. Others currently are under negotiation. Cooperative satellite launching programs are being undertaken with Canada and England and initial discussions have been held with several other nations. We have participated actively in the deliberations of the U.N. Ad Hoc Committee on the Peaceful Uses of Outer Space,and of COSPAR, the Committee on Space Research of the International Council of Scientific Unions. In all of these activities, we have worked closely with, and have had the counsel and support of, the State Department.

I have not attempted in this statement to go into detail on any of these program and operating matters. As I pointed out earlier, my associates will present those I have mentioned, and several others,in sufficient detail to give you a good picture of the Nation's program and plans for space exploration. In this regard, the Associate Administrator will present a plan for research and developmental activities extending several years into the future. He will point out, of course, that any research and development plan is subject to continuing review and can be considered valid only to the extent that it is funded. Nevertheless, we believe we have developed a plan that will guide our programming toward significant and ambitious milestones and end objectives.

Now, if I may, I want to turn again to budgetary matters. There is pending before the Congress our request for supplemental funds for fiscal year 1960 in the amount of $23,000,000. You will remember that your Committee authorized expenditures of $530,000,000 last spring, but the Congress appropriated $500,575,000. It is hoped that the Appropriations Committee will act promptly on this request, the majority of the funds being required for our top priority project -- Mercury.

New obligational authority in the amount of $802,000,000 is requested for fiscal year 1961. I believe this sum, together with the additional amount we will request for acceleration of the super booster program, will enable us to carry forward vigorously the program we will present to you. I should note, however, that ours is almost wholly a research and development operation, with all of the uncertainties and unforeseen problems that accompany any such activity. We are dealing with an enormously complicated technology. The most significant of our space experiments must operate in environments and under conditions not easily reproduced for component testing in ground-based facilities. A few conditions cannot be reproduced at all. Furthermore, almost all significant tests and experiments result in the destruction of the rocket and payload. Re-use is impossible, or nearly so. All of this adds up to an expensive business. And this budget is a tight budget.

It provides for a determined and vigorous program to develop reliable launch vehicle systems with the thrust necessary to propel the spacecraft on the missions we want to undertake. It provides for the urgent prosecution of Project Mercury. It is intended to make possible difficult experiments in both the communications and meteorological fields. It provides for a significant number of flights for the purpose of probing more deeply into the secrets of outer space as we build up our knowledge of the conditions to be met by future human voyagers to the moon and beyond. It provides support for the basic and applied research and advanced component development which is necessary to undergird any program of this kind.

In short, this budget is intended to provide for the urgent prosecution of the Nation's program in space exploration in all its phases, with particular emphasis on the super booster developments. If approved, I am as certain as anyone can be in the research and development game, that we will accomplish our goals for the coming fiscal year and will have taken significant steps forward toward the attainment of the long-term objectives we have set for ourselves. Respectfully, I urge you, Mr. Chairman, and I urge the members of your Committee, to approve this budget request as soon as you have satisfied yourselves on the validity of our requirements. Delays in both authorization and appropriations actions will severely limit our abilities to plan for, and proceed with, our difficult tasks.

And now, I would call your attention to the schedule of presentations to be made by my colleagues and associates. Each of us will be happy to explain, as fully as we can, any aspect of our program and to answer your questions to the best of our ability. Thank you again for this opportunity to appear before the Committee.

# # #

NO. 16-110

FOR RELEASE UPON
PRESENTATION

Statement by
Dr. T. Keith Glennan, Administrator
National Aeronautics and Space Administration
before the
House Committee on Science and Astronautics
January 28, 1960

Mr. Chairman and Members of the Committee:

I am grateful to the Committee for giving me this opportunity to explain the reasons for withholding certain documents from examination by the General Accounting Office and this Committee.

The documents in question all relate to advice which was given to me by subordinates in NASA to assist me in selecting contractors for two of our large research and development projects. In the first case, I selected the Rocketdyne Division of North American Aviation, Inc., as the contractor for development of a single chamber, liquid fuel, rocket engine capable of generating a million and a half pounds of thrust. In the other case, I selected McDonnell Aircraft Corporation for the development and manufacture of capsules for manned satellite flight in Project Mercury. In each of these cases, my decision was made after receiving and carefully weighing the advice of a Source Selection Board.

Because of the nature of the work, it was not feasible in either of these cases to advertise for bids. Instead, it was necessary to solicit proposals from a number of interested firms, to decide which of the firms submitting proposals appeared best qualified to do the job in the light of all relevant factors, and to negotiate a contract with that firm. This procedure is authorized by section 2304 of Title 10, U. S. Code.

I shall briefly describe the steps which led up to the selection of a contractor in each of these cases.

Contract with Rocketdyne Division of North American Aviation, Inc.

In the case of the large rocket engine development, action was initiated by NASA on October 14, 1959, by extending invitations to the following seven firms to attend a briefing conference by NASA personnel at NASA headquarters:

Aerojet-General Corporation
Bell Aircraft Corporation
Wright Aeronautical Division, Curtiss-Wright Corporation
Aircraft Gas Turbine Division, General Electric Company
Rocketdyne Division, North American Aviation, Inc.
Reaction Motors Division, Thiokol Chemical Corp.
Pratt and Whitney Aircraft Division, United Aircraft Corp.

These were the only companies with the known experience and capability of designing a new rocket engine of very high thrust.

On October 21, 1958, a briefing of the companies invited to submit proposals was accomplished at NASA Headquarters; and on October 23, 1958, NASA specification HS-10 was sent to them. Thereafter, clarifications and answers to questions posed by bidders with respect to the invitation were furnished to all competing companies under letters dated October 28, October 30, November 13, and November 14, 1958.

On November 24, 1958, six of the seven invitees submitted proposals. Bell Aircraft Corporation declined to do so.

On the same date, two assessment teams were organized for purposes of making a thorough analysis and evaluation of the six proposals submitted. One of the teams consisted of scientific and technical specialists, and the other was composed of management and cost specialists.

On December 2, 1958, I appointed a Source Selection Board to review the work of the assessment teams, evaluate the entire matter, and provide me with advice concerning the selection of a contractor for the development of the engine. The Board consisted of the following persons holding responsible positions in NASA Headquarters:

Dr. Abe Silverstein, Director of Space Flight Development, Chairman
Mr. John W. Crowley, Director of Aeronautical and Space Research
Mr. Ralph E. Cushman, Procurement and Supply Officer
Mr. Abraham Hyatt, Assistant Director for Propulsion, Office of Space Flight Development
Mr. Robert G. Nunn, Jr., Assistant General Counsel

On December 12, 1958, the Source Selection Board met with me to present and discuss its recommendations. After receiving the Board's advice, I selected the proposal of the Rocketdyne Division of North American Aviation, Inc., for purposes of initiating negotiations. Rocketdyne and NASA started contract negotiations on January 5, 1959, and on January 9 an agreement was achieved.

Contract with McDonnell Aircraft Corporation

In the case of procurement of the manned capsule for Project Mercury, action was initiated by NASA on October 23, 1958, when preliminary specifications were mailed to a number of qualified firms. On November 7, 1958, a bidders' conference was held at the Langley Research Center. Thirty-eight firms were represented.

On November 17, 1958, final specifications were mailed to twenty companies which had indicated a desire to receive them. By December 15, 1958, the following twelve companies had submitted proposals:

AVCO, Research and Development Division
Chance Vought Aircraft, Inc.
Convair Astronautics
Douglas Aircraft Company, Inc.
Grumman Aircraft Engineering Corporation
Lockheed Aircraft Corporation
Martin Company (with RCA, Astro-Electronics Products Division)
McDonnell Aircraft Corporation
North American Aviation, Inc. (with General Electric MSVD)
Northrop Aircraft, Inc.
Republic Aviation Corporation
Winzen Research Laboratories

Following the pattern established in the selection of a contractor to develop the large rocket engine, I appointed a Source Selection Board consisting of the following persons in NASA Headquarters:

Dr. Abe Silverstein, Chairman
Mr. Ralph E. Cushman, Procurement and Supply Officer
Mr. George M. Low, Chief, Manned Space Flight
Mr. Walter D. Sohier, Assistant General Counsel
Mr. DeMarquis D. Wyatt, Technical Assistant to the Director, Space Flight Development

As in the earlier case, the Board was assisted by technical assessment and management assessment teams.

On January 9, the Board presented its recommendations to me. After receiving its advice, I decided that the interests of the Government would be best served by the selection of McDonnell Aircraft Corporation to develop the manned satellite capsule for Project Mercury.

On May 28, 1959, the Chairman of this Committee addressed a letter to me requesting certain documents pertaining to the contract with the

Rocketdyne Division of North American Aviation. The letter included a request for a copy of the contract, NASA's specifications and requests for proposals, a memorandum of the bidders' conference, proposals received by NASA from the competing companies, reports of NASA's technical assessment and management assessment teams on the proposals, and the report which the Source Selection Board made to me.

I replied to the Chairman by letter dated June 15, 1959. My letter enclosed a copy of the contract and specifications and informed the Committee that the contractors' proposals, which consisted of a number of voluminous documents, would be made available at NASA Headquarters for review by persons authorized by the Chairman. It informed the Chairman that no memorandum of the bidders' conference had been made, but a list of persons in attendance at the conference was furnished to the Committee. It also explained that no written reports had been presented by the technical assessment and management assessment teams, as they had made their presentations to the Source Selection Board orally. The letter described the composition of the teams, the factors which they had considered, their mode of operation, and the time which they had spent at their tasks, including the fact that they had taken two full days to make their oral presentations to the Source Selection Board. Finally, in response to the Committee's request for a report of the Source Selection Board, my letter contained the following statement:

> "This document contains the personal evaluations and recommendations of certain officials of NASA whom I consulted to aid me in reaching my decision on the selection of a prospective contractor. Since this document discloses the personal

judgments of subordinates made in the course of preparing recommendations to me, I am sure you will agree with me that it would not serve the interests of efficient and effective administration of this agency for such a document to be reviewed by anyone outside of NASA."

On July 9, 1959, Mr. Raymond Wilcove, staff consultant to this Committee, addressed a letter to Mr. James P. Gleason, NASA's Assistant Administrator for Congressional Relations, requesting certain information and documents pertaining to the contract with McDonnell Aircraft Corporation. The request was for essentially the same type of material as had been requested by the Chairman's letter with respect to the large rocket engine contract. Mr. Gleason's reply, dated August 19, 1959, was completely responsive to Mr. Wilcove's requests with the exception that it refused to furnish a copy of the report which the Source Selection Board made to me and copies of the reports which the technical and management assessment teams made to the Source Selection Board. Mr. Gleason's letter contained the following statement:

"As in the case of the Rocketdyne contract which was explained in the Administrator's letter to the Chairman on June 15, 1959, and which was more fully discussed informally with Chairman Brooks, documents containing personal evaluations and advisory opinions prepared to aid the Administrator in the selection of a contractor to develop the capsule are of such a nature that it would not serve the interests of efficient and effective administration of NASA for such documents to be reviewed by anyone outside of NASA."

In the case of both contracts, a detailed statement was prepared at my request and personally approved by me setting forth a full description of the procedures employed by NASA in connection with solicitation and evaluation of contractors' proposals and all of the factors on which

I based my decisions to select Rocketdyne and McDonnell over their competitors. These statements have been freely available to the Committee and its staff, as well as to the General Accounting Office.

They were prepared some months after the award of these contracts; but I can assure the Committee that their objectivity was in no way impaired by that fact. I made the decisions in these cases; and these documents correctly and fully reflect the criteria which were used in evaluating the various proposals and the factors upon which I relied in making my selections.

Both in my letter of June 15 to the Chairman and in Mr. Gleason's letter of August 19 to Mr. Wilcove, the Committee was assured that, if it would be beneficial or helpful to the Committee in any way, I would be happy to explain fully the reasons for my decisions to select the Rocketdyne and McDonnell proposals as the bases for contract negotiations. I have received no request to provide the Committee or its Staff with additional facts or a further explanation of my decision.

In this connection, I think it is important to note that none of the documents which have been withheld relates to the negotiation, the terms and conditions, or the administration of either the Rocketdyne or McDonnell contract. These documents relate solely to the advisory process within NASA which was designed to assist me in selecting the company with whom negotiations should be undertaken.

On August 19, 1959, the Comptroller General advised me by letter that the General Accounting Office had been requested by this Committee to review the procedures followed by NASA in the award of the Rocketdyne contract. His letter contained the sole request that I make available for examination by the General Accounting Office a copy of the report which the Source Selection Board had made to me prior to award of that contract. I replied by letter dated August 28, 1959, and enclosed a copy of my letter of June 15, 1959, to the Chairman of this Committee. I informed the Comptroller General that the reasons for not making the document in question available for examination by a Congressional Committee are equally applicable to the General Accounting Office.

Subsequently, I received a letter from the Comptroller General, dated December 7, 1959, requesting access to reports of the Source Selection Board and its advisory committees relating to the award of the contract for the Project Mercury capsule to McDonnell Aircraft Corporation. In my reply, dated December 23, 1959, I repeated the reasons which I had stated in my previous letter for not being able to comply with the Comptroller General's request.

Since the Comptroller General had cited section 313 of the Budget and Accounting Act of 1921 (31 U.S.C. 54) as authority for his request, I felt it necessary to point out in my reply of August 28 that the privilege of the Executive to withhold documents in cases such as this has a constitutional rather than a statutory basis and, accordingly, cannot be affected by the statute which he cited.

Along this same line, I might add that we are not relying on any provision of the National Aeronautics and Space Act of 1958 as granting NASA authority to withhold the documents in question. Nor do we regard section 303 of that Act as restricting the privilege of the Executive to withhold documents from the Legislative Branch when such action is required in the public interest to protect the effective operation of the Executive Branch. Since this privilege of the Executive is based upon the constitutional principle of the separation of powers between the Legislative and Executive Branches, it is evident that it cannot be impaired by enactment of a statute. A careful reading of section 303, moreover, reveals that it does not purport to deal with this question. It merely states that "nothing in this Act" authorizes the Administrator to withhold information from the committees of the Congress. The Executive privilege is not derived from this or any other Act.

I understand that the General Accounting Office does not agree with me that disclosing the personal judgments of subordinates made in the course of preparing recommendations to the Administrator would not serve the interests of efficient and effective administration of NASA. The General Counsel of the General Accounting Office has said in his statement to this Committee: "There seems no reason to think that such an action would promote a tendency of subordinate NASA employees to soften criticism, avoid doubtful matter, and generally offer more restrained opinion, which is apparently the basis of the Administrator's position."

Without conceding that this statement fully reflects the basis of my position in this matter, I believe that the most appropriate reply I can make is to quote from two recent letters addressed by the President to the Legislative Branch.

In a letter dated November 10, 1959, to the Chairman of the Subcommittee on State Department Organization and Public Affairs of the Senate Committee on Foreign Relations and in a letter dated December 15, 1959, to the Comptroller General, the President expressed the reasons for withholding certain documents in words which seem to me to be directly applicable to the present case:

> "It is essential to effective administration that employees of the Executive Branch be in a position to be fully candid in advising with each other on official matters, and that the broadest range of individual opinions and advice be available in the formulation of decisions and policy. It is similarly essential that those who have the responsibility for making decisions be able to act with the knowledge that a decision or action will be judged on its merits and not on whether it happened to conform to or differ from the opinions or advice of subordinates. The disclosure of conversations, communications or documents embodying or concerning such opinions and advice can accordingly tend to impair or inhibit essential reporting and decision-making processes, and such disclosure has therefore been forbidden in the past, as contrary to the national interest, where that was deemed necessary for the protection of orderly and effective operation of the Executive Branch."

Members of the Committee, I wish to emphasize one point. I regard the business of NASA as public business. I believe in the widest dissemination and fullest disclosure of both scientific and administrative information concerning my stewardship of NASA. I think a public servant should live in a goldfish bowl in his official capacity.

It follows, as I have said before, that a full and complete accounting for my actions as Administrator of NASA is right and proper.

For these reasons I directed that factual and fully informative statements be prepared concerning the Rocketdyne and McDonnell selections. The statements submitted to the Committee are my statements. But, in addition, I stand ready and will make myself available to answer for my actions and to respond to the best of my ability to any question of fact or issue of judgment that may be involved.

With this in mind, let me say one final word. I hope that the Committee and I can proceed, from the same basic ideas of responsible government, to a resolution of the narrow issue raised here involving some four documents. I do not want to withhold information from the Congress or the public. I do want to maintain an effective administration of NASA.

.....

NASA RELEASE NO. 60-112

28 Jan 60

THE NATIONAL SPACE EXPLORATION PROGRAM

Hugh L. Dryden, Deputy Administrator
National Aeronautics and Space Administration

(Prepared for Congressional Testimony, 1960)

I appreciate the opportunity of describing to you the philosophy and structure of the national space exploration program for accomplishing the general objectives of the National Aeronautics and Space Act of 1958. Dr. Glennan in his opening statement gave you an evaluation of our position with respect to that of our competitor and outlined the course which must be followed. We must establish the long-term goals, we must determine the technical tasks necessary to press forward toward those goals, and we must develop the organization and management to accomplish these tasks. In the sixteen months since NASA was formally established on October 1, 1958, great progress has been made in the formulation and initiation of a comprehensive integrated program of action.

The most visible and spectacular aspect of the space activities under way is the succession of launching of space vehicles at Cape Canaveral, some successful and some unsuccessful. These launch vehicles are intended to boost a spacecraft across the frontier into outer space to perform those missions needed to reach our national objectives. As the launch hour approaches, as you know, the labors and hopes of hundreds of scientists, engineers, technicians, the work of months and years, come into general public view for the first time. We begin to understand that much of the space program in progress at a given time, for example today, is aimed toward missions to be flown later. Our integrated space program is like an iceberg. The parts in view, above the water so to speak, are the smaller part of the total effort required to perform successful missions in space. Most of the iceberg is under water, hidden from view.

The general pattern of activities necessary to a specific flight mission is represented schematically on the accompanying chart. Each mission requires a suitable launch vehicle system to launch the spacecraft into orbit or to great distances from the earth to the moon or planets. Each mission requires a spacecraft equipped for the specific purpose and provided with the instrumentation, telemetry, and other apparatus to accomplish the desired mission. We often call this apparatus the payload. Each mission requires the operation of suitable ground facilities to receive and record telemetry, to track the spacecraft for determining its position continuously, to photograph its track, send command signals, or whatever else may be required by the mission.

Developments in these three areas and the missions to be carried out must be planned together in proper time phase; the possible missions are in fact determined by developments in launch vehicle systems, spacecraft components, and available tracking and telemetry systems.

This lead-time aspect is a most characteristic feature of space activities. It is found in many other areas of our life today, even in legislative activities. The history of a given space flight is analogous to the history of a bill in the Congress. Some bills are passed and signed and hence are successful. A bill under active debate on the floor has its roots extending well into the past, perhaps to previous sessions of the Congress. Space missions we hope to execute in the next few months correspond to bills in committee hearings. Our advanced research and technology corresponds to committee hearings and staff investigations on general topics. Research not only supports specific space missions but also generates new missions.

To undertake a specific space flight mission a year or more from now, many decisions must be made now and many tasks must be begun now relating to activities at the lower levels of our iceberg-like chart. These must be pursued vigorously in the intervening months. For example, the budget before you for FY 1961 supports the design and procurement of vehicles and payloads and related research and development which does not appear as a flight mission until FY 1962 or later. The lead time required may vary from a few weeks or months for a simple sounding rocket with more or less standard instruments to years for a completely new super-booster. It is an exceptional and usually rather minor space project which can proceed from concept to flight in a few months. The Atlas booster just becoming available to us was initiated with highest priority five years ago. Thus our overall program presents to the spectator a kaleidoscopic mixture of matured developments, actively developing hardware, short-range applied research and component development, and longer range advanced research which determines our position a few years in the future.

Our current missions are being performed with launch vehicle systems based on the intermediate range ballistic missile boosters, Thor and Jupiter. Multi-stage launch vehicle systems based on the intercontinental ballistic missile booster Atlas as the first stage are well along in development and are scheduled for missions in 1961 and beyond. A DX priority (the highest national priority) has been assigned to the Saturn launch vehicle system based on a new super-booster being developed specifically for space vehicles. The Saturn system is required to give us the capability of advanced space missions, both manned and unmanned. It is the key to our possible accomplishments in the period beyond the next few years.

Last year we presented to you the concept of the <u>National Booster Vehicle Program</u> which we now prefer to call <u>National Launch Vehicle Program</u>. The nation cannot afford to design a specialized and optimized vehicle for each of the dozens of missions. NASA and the Department of Defense seek to develop the smallest number of vehicles that will encompass the entire range of presently envisioned missions.

There is another reason for such a course in addition to the necessity of avoiding unnecessary duplication and expense. This is the hard fact of experience that a new launch vehicle cannot be designed on the drawing board, manufactured, and launched with an expectation of a high probability of success on the first mission. The first five or ten flights must be regarded as development tests of the launch vehicle to gain reliability. By using the same vehicle for many missions, a high degree of reliability will be reached earlier, our dollars will go further, and our relative competition position will be enhanced. In initiating our space program sixteen months ago we had to order interim vehicles which could be obtained within one year in order to gain flight experience now. We are, however, moving as quickly as possible to five vehicles as will be described by a later speaker.

The ground tracking and telemetry networks are the means by which the results of space exploration are received on the ground. The optical and Minitrack network established during the International Geophysical Year has, with some extension to cover polar orbits and with the normal improvements, proved adequate for unmanned earth satellites. Project Mercury requires special provisions because of the presence of the astronaut; it uses existing military stations and some new portable stations along the intended trajectory. The needs of the deep space probes are met by three stations using large antennae, one of which exists at Goldstone, California; one is under construction at Woomera, Australia; and the third is scheduled.

Our philosophy in this area is to integrate our stations with those of the Department of Defense, utilizing existing stations wherever possible and installing temporary movable stations to accommodate temporary needs. A later speaker will give you a complete picture of these ground support facilities without which the whole activity would be useless.

Many spacecraft are peculiar to the intended mission. Some require attitude stabilization, retro-rockets, or other special components. Auxiliarypower, telemetry, and sometimes other communication or command transmitters are needed. The instrumentation is that required by the mission.

In addition to these three underlying areas of development which directly support and are closely integrated with specific missions, a broad foundation of advanced research and technology carried out in laboratory facilities on the ground is prerequisite to leadership in space exploration. The technological problems are most rapidly and economically solved in ground facilities which simulate the launch and space environment as fully as possible, i.e., as regards vacuum, temperature, noise, vibration, acceleration, loads, etc. Research explores the new areas, new knowledge of the fundamentals of propulsion, of effects of meteorites on structures, of new phenomena in solid state physics, or in plasma physics, and provides new ideas for study and exploitation.

The lead-time aspect of research activity may be illustrated by a historical example, research on the reentry heating problem which gave the foundation for the concept used in Project Mercury. About ten years ago the scientific community and industry were all following the idea of using slender sharp-nose bodies for ballistic missile warheads. NACA research showed that such sharp-nosed bodies--illustrated at the left of the chart--absorb about thirty percent of the aerodynamic heat which is generated during atmospheric reentry. During atmospheric entry, the heating of the body would be so great that no known high-temperature materials and structures could stand the temperatures which would be experienced. In 1953, Mr. H. J. Allen of the Ames Research Center showed that a blunt reentry shape generating a large bow shock wave would generate most of the heat within the atmosphere itself, and that less than one-half of one percent of the heat would be absorbed by the body. This basic research finding led to the blunt-body concept used by all present ballistic missile nose cones. In subsequent years, concentrated research effort on these problems has led us to a better understanding of basic flow and heat transfer phenomena at speeds approaching orbital velocities.

By the time the Soviet Union had launched Sputnik I into an earth orbit on October 3, 1957, researchers at our Langley and Ames Research Centers were studying problems of manned satellite capsules. However, the key to the problem of allowing a manned capsule to withstand high reentry temperatures had been developed from our basic research in 1953 on general problems of high-speed flight and later studies relating to the reentry into the atmosphere of ballistic missile nose cones. It is apparent the nature of research is such that the application of the results is often not foreseen at the time the studies are initiated.

There is a constant interaction between the various elements of this integrated space exploration program. Not only does the foundation of advanced research and technology give results leading to new vehicles, new telemetry and tracking devices, and new instrumentation and thus to new missions made possible, but the desired goals and missions suggest vehicle, telemetry, and instrumentation developments which should be carried out and these in turn lead to the need for research in certain areas. Thus a great deal of our current research is suggested by the problems of landing a man on the moon, of operating a manned station in space, or of operating an unmanned astronomical observatory. The results obtained are, however, basic in character and applicable to many other specific missions as well.

Having examined the structure of the program underlying a specific mission, let us look at the space flight missions of the national space exploration program. They fall into three categories: those directly concerned with the travel of man himself into space, in the foreseeable future throughout the solar system; the application of earth satellites to human benefit; and the scientific study of the space environment. Together these categories form a single integrated program of space exploration and no category can be neglected without detriment to the others. Thus it is obvious that the results of the scientific study of the space environment, for example, quantitative detailed information on the Van Allen radiation belt and on the impact of meteorites, are essential to the design of reliable space vehicles to be used either for applications to civil and military purposes or for habitation by man. Similarly the accomplishment of various steps in manned flight contributes to the scientific knowledge of space and provides a technology for making more difficult scientific measurements by human observers or by very heavy apparatus such as a large telescope. In either category, unforeseen new knowledge may well revolutionize accomplishments in the other category.

A DX priority (the highest national priority) is assigned to Project Mercury, the first step in the travel of man in space at satellite speeds and beyond. This program includes as a preparatory mission the travel of man in a ballistic trajectory, during this calendar year, if everything goes well. Soon thereafter we will begin to gain direct experience in the orbital flight of man. A progress report on Project Mercury will be given by a later speaker.

Our program looks forward to a continually increasing capability and accumulation of experience. Much of our advanced research and technology is planned to attack the problems to be encountered in the travel of man to the moon and his safe return to earth. As we advance toward this goal, we must achieve such intermediate goals as a manned space station in orbit about the earth and the flight of man to orbit the moon and return safely to earth. We must develop spacecraft capable of reentering the earth's atmosphere not only from earth satellite speeds without excessive heating or deceleration, but also from the much higher speeds involved in return from the moon. We know already that there is a difficult guidance problem connected with the safe return through the atmosphere.

The program includes missions leading to the applications of earth satellites for peaceful purposes to promote human welfare. These applications have been of great interest to men of all nations. The development of meteorological satellites is one of the important goals of the national program. Still in the earliest research and development stage as regards the instrumentation, the results already obtained open new vistas to the forecaster and research scientist alike. A second application of special benefit to the Western world is that to the task of long-distance communication.

The third category of missions includes those used for the unmanned exploration of space. Satellites and space probes can carry our measuring instruments far into space, in time to the far reaches of the solar system. They do precede man and explore the way for him, but more important they extend the body of scientific knowledge about the earth, its atmosphere, ionosphere, and other aspects of nearby space, about the moon and planets, and about our entire universe. Although we speak of this program as a space science program, it in fact includes a multiplicity of programs in gravitational, electrical, and magnetic fields, cosmic rays, electrified particles, radiations of all wave lengths, in fact all branches of physics and chemistry extended into outer space. The results promise to benefit our activities on earth as much as our activities in space, and in a sense this category of missions also represents the application of satellites and space probes for peaceful purposes to promote human welfare.

The accomplishments of the national space exploration program to date have been substantial. Experience in its conduct has made us more acutely aware of the unknown factors in the conduct of research and development on the previously unexplored frontiers of space. The course ahead for several years is well established and we have made plans for a decade ahead in the light of our present knowledge. We expect to revise these plans from time to time in the light of the experience gained.

Mr. Horner will describe the long-range plan and discuss the organization and facilities which have been assembled to carry out the national program of space exploration.

. . . . .